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Integrated Transportation Management Systems (ITMS) Conference

ITMS: A Key Strategy to Optimize Surface Transportation System Performance

White Papers

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16. Abstract

This report provides the technical papers prepared for the 4th Integrated Transportation Management Systems (ITMS) Conference held in Newark, New Jersey on July 15-18, 2001. The Conference was sponsored by the Transportation Research Board (TRB), the Institute of Transportation Engineers (ITE), the Federal Highway Administration (FHWA), and ITS America. The papers are available on the Internet at www.tmcite.org.

The seven papers cover a variety of topics. Subjects addressed in the white papers include defining ITMS, institutional issues and opportunities, planning for ITMS, designing for ITMS, management and operations, traffic management strategies and operational plans, and performance measurement.

The proceedings from the Conference are provided in a separate report, 4th *Integrated Transportation Management Systems (ITMS) Conference: Conference Proceedings.* (EDL Document Number 13481)

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DEFINITION OF ITMS

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April 2001

Definition of ITMS

ITMS is simple but profound concept. The concept began as integrated *traffic* management systems and built upon the notion of sound traffic engineering principles that had been practiced for many years. The concept was being promoted at the same time that the Intermodal Surface Transportation Efficiency Act (ISTEA) was charting a new direction for transportation policy and funding. The basic idea was to bring the various tools and techniques of transportation system management (TSM), congestion pricing, transportation control measures (TCMs), and intelligent transportation systems (ITS) into a more system oriented package. The name evolved to integrated *transportation* system management to reflect the broadening role.

It is difficult to precisely define ITMS because it includes many portions of other processes in surface transportation system operations. It is a bridging function between the various day-to-day operating components of the surface transportation system through a process that focuses on the sharing of information and resources in manner that facilitates a more seamless operation.

The Freeway Operations Committee of the Transportation Research Board developed the following definition: "An 'integrated transportation management system' (ITMS) provides for the automated, real-time sharing of information between ITS based systems and the coordination of management activities between transportation agencies, thereby enhancing system interoperability and enabling an area wide view of the transportation network. These systems and agencies provide for the management and operation of a variety of different transportation facilities and functions, including freeways, arterial streets, transit (bus and rail), toll facilities (e.g., bridges, tunnels), emergency service providers, and information service providers."

The Freeway Operations Committee further amplified on the concept by focusing on the effect of ITMS: "Synergy between multiple systems is absolutely necessary to achieve the vision of an efficient, effective, and seamless transportation network. In fact, the definition of the word "synergy" aptly describes the goal of an integrated transportation management system. From the Greek word "synergos" (working together), it refers to the interaction of discrete agencies and their systems such that the total effect is greater than the sum of the individual effects."

The reason why an ITMS vision is needed stems from the current way agencies conduct business. The basic institutional fabric of the surface transportation system is multi-jurisdictional, multi-agency, multi-functional, and multi-modal. This structure leads to a fragmented delivery system for transportation service. The existing system also tends to take an agency focus rather than focusing on the customer's real needs. The above definition, therefore,

should be modified slightly to also reflect the user perspective of a system that should operate as if under single ownership and management.

ITMS is, therefore, the concept that links the day-to-day operations of the various operating agencies into user oriented system. From a user perspective, traffic signals should be coordinated across jurisdictions and the freeway traffic management system should work collaboratively with arterial system management. However, the true vision of ITMS broader than freeway and traffic signal operations. It would recognize that a person making a trip might drive to a park and ride lot, take a bus to near work, and finish the trip on foot.

While reaching the vision of ITMS was difficult in the past, it is now very possible due to the development of various tools including intelligent transportation systems, a national architecture, and the necessary standards to support ITMS. ITS provides the tools to allow operating agencies to share information and resources, and to provide coordinated operations. The National ITS Architecture and associated standards facilitate sharing information and coordinated operations because the meaning of various data elements is known and consistent across agencies. Despite the potential of ITMS, many issues must still be addressed including costs, benefits, developing a consensus, and funding the program in a manner necessary for success.

Costs And Benefits Of ITMS

The first logical question concerning ITMS is what are the benefits? The answer is again both simple and complex. Clearly capacity, safety, system performance, and customer satisfaction improve with better operations. There are numerous examples of individual parts of the system being improved through isolated application of improved traffic signal timing or incident management, to name just two examples. Because ITMS often links systems that have not been previously linked, like ramp metering and traffic signals, the benefits of some applications are not well documented. Further, as combinations of strategies are applied, the contributions of individual strategies are difficult to separate. Finally, some benefits such as improved emergency vehicle response are real but difficult to quantify using traditional economic analysis tools, but never the less of real value.

One difficulty with ITMS benefits is they do not necessarily directly accrue to the agency or jurisdiction providing the service. The benefits accrue to the users, but the costs accrue to the providers. Therefore, because many ITMS solutions require ongoing agency expenditures, which must compete with other services including new construction and maintenance, continued attention must be given to making the case for ITMS. However, those promoting the benefits must also move beyond traditional highway based analyses, which focus primarily on delay and user costs. When has a highway project considered the effect of improved emergency vehicle response or improved bus priority? The benefits of achieving appropriate policy based operations offers new potential to achieve the necessary political support of ITMS.

Are We Making Any Progress?

Clearly we are making progress. We have a national architecture to guide in development of ITMS systems. We are seeing increased deployment of ITS components. We are also making progress in the development of standards to support ITMS. FHWA is encouraging integration

through innovative requirements in the expenditure of ITS funds. These developments and the associated tools make achievement of ITMS easier from a technical standpoint.

However, we have had only limited success in seeing the bigger picture of ITMS. The success of ITMS is dependent upon agency champions promoting the value of integrated operations and being willing to partner other parts of their organization or being even bolder and partnering with other agencies. The I-95 Coalition is one example of agencies coming together to provide better operations. Hopefully this conference will continue to identify the lessons learned from various projects through out the country that are approaching different aspects of the vision.

Clearly, progress is difficult and slow. Considering that it took more than 40 years to finish the Interstate Highway System, a profoundly simpler vision, it will take many years to see the investment in operations to reach the vision of ITMS.

What are the Obstacles?

There are many obstacles to change, the most basic being that human beings are most comfortable with the status quo. Change requires some risk of confronting unknown territory. Change also entails some risk of failure. All this makes change a challenge, regardless of the technical or institutional challenges.

But the biggest obstacle is we are organized to solve problems of the last century. When we had few roads and most were not paved, we need to develop a system of constructing roads. And who better to build the infrastructure than civil engineers. We developed a system to plan, design, and construct highways. Operations and maintenance, while necessary, was clearly not the mission. But the problems of the 21st Century are clearly different. We have lots of roads, but they are not all operating well.

We now have the finest system in the world from an infrastructure standpoint, yet we are operating using the same paradigm of the last century, constructing a system to get the farmer out of the mud. It isn't that road building is over, it just is not as important as it used to be. Maintenance is clearly more important given the extensive system we have in place. One only has to look at some of our older cities to see what a lack of maintenance can to operations. In many cases, we would have an even worse maintenance problem if we had not build new roads to replace those that were "obsolete." So the biggest challenge is to build a new way of doing business, which recognizes that operations, management, and maintenance are bigger challenges than they used to be.

What Is The Next Step?

I believe the next step is the continual promotion of the concept that we can better operate the system and ITMS is part of improved operations. This process will require action on many fronts. Awareness of the availability of tools to assist in the implementation of ITMS is as important as promoting the concept. One must not only want to improve operations, they must also see a path to implementation.

It is also necessary to build a political constituency to support better operations. This requires understanding there is more to success than having the right answer. My favorite example is the traffic engineer who opposes fire priority because it "messes up" progression. That view ignores the political and policy reality that fire trucks should not have to be delayed due to red lights. If the traffic engineer saw the fire chief a political friend, then they could jointly argue for a better traffic control system.

Perhaps the largest challenge is building support for operations funding. Without financial support, operations is just another potentially good idea. In fact, investing only in capital improvements for operations has a clear negative effect on operations. Simple is clearly better than complex unless there is support for operations, management and maintenance.

But it is also necessary to document the success stories. These need not be traditional benefit/cost studies. It is more important to document real examples of how the quality of transportation operations has been improved with ITMS implementations. Without a significant constituency for operations, it will continue to receive limited funding and support. More success stories would be helpful. These success stories should involve innovative applications that cross-traditional institutional structures and can be understood for their intrinsic value. Improving the response time of an ambulance through improved integrated operations is a benefit that does not require a benefit/cost ratio to be understood.

PLANNING FOR OPERATIONS

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Introduction

Effective transportation system management maximizes system performance through a coordinated and integrated decision making approach to 1) construction, 2) operation, 3) maintenance, and 4) preservation of transportation facilities in order to provide safe, reliable, predictable, and user-friendly transportation services. Typically, construction, preservation, and maintenance receive a substantial amount of funding, political support, and supportive planning within the context of state, local, and regional service and facility providers. However, given the tremendous demographic, societal, and technological changes and growth that have occurred in our society over the last 25 years, and that can be expected to continue well into the new millennium, operations is beginning to be the focus of attention of planners, and providers of transportation services, systems, and facilities. As we move further into the 21st Century, much of the thrust of operations will be to make the elements of the surface transportation system (for roadways, for public transit, and for rail) work better and together to help achieve the goals for effective transportation system management. However, accomplishing better operations starts with better "planning for operations." The attention of this paper is on "planning for operations."

The purpose of this white paper is to define the concept of "planning for operations" (or planning for management and operations) and make the case for it being a necessary and formally recognized, institutional function for both operating agencies and planning organizations. In making this case, the paper will present the following:

1. Some background on the environment within which our systems operate today,
2. A definition and scope for "planning for operations,"
3. The different perspectives and elements of "planning for operations,"
4. Why is "planning for operations" important,
5. Principle factors to consider in "planning for operations."
6. Expectations from successful "planning for operations"

Some Background

As a society, we are very different from the way we were in 1975. Our demographics are different. Our thoughts on travel are very different. Our ability to travel is very different. Routine congestion has become an accepted, yet annoying, part of our daily lives for auto users, transit users, shippers, and deliverers of goods. The transportation needs of our travelers are very different because we are in an information age that fuels rising customer expectations and demands. There have been significant changes in our demographics, life style, economy and technology that also fuel rising expectations and demands on the transportation system. Even in the face of these significant societal changes, growth, system complexities, and varying travel situations, our transportation system is managed and operated much like it was in 1975.

Traditional lessons and project-oriented approaches about how to improve traffic flow are still valid. However, these traditional approaches tend to be problem-focused and unable to address the more service-oriented, performance-based, culture that we are moving towards for the future. Society and the concept of travel is being redefined because of factors like affluence, access to jobs and housing, life-style and family demands, just-in-time delivery, information technologies, economic development, globalization, and the desire for a better quality of life (quality of travel being a subset of quality of life).

The goals for transportation have expanded over the last decade and will change in the future. They go beyond just moving commuters and their vehicles faster and safer during the peak period. Transportation is a central part of many goals: economic development (ranging from housing and employment growth to e-commerce), quality of life, shipping and delivery, access to jobs and skilled workers, tourism, special events, mobility and accessibility, environmental justice, and public safety. There are a variety of users to consider, e.g. tourists, sports fans, shipper/deliverers, employers, commuters, and former welfare recipients. Peak demands don't just occur during commuting times. They may occur weekends or evenings at shopping malls or special events. Operating the transportation system and providing essential transportation services has become a 24 hour-a-day, seven day-a-week job for cities, counties, States, and regional operating agencies.

The system that has been built will be required to accommodate expected growth (economic and in travel demand) as well as to help government realize these goals for its citizens over the next 5 to 15 years - - well within the time-frame before any new major infrastructure expansion can be put into service. This growth (primarily economic and population) is occurring faster then our ability to put new infrastructure capacity into service. System preservation and maintenance cannot address this growth and the anticipated travel demands it could bring. Growth as well as other key trends (such as access to jobs and skilled workers) will force greater attention to the shorter-term role that better transportation operations can play helping to meet and/or sustain a broad range of community, economic, and quality of life goals, even though infrastructure expansion may be planned for in the distant future.

A lot about planning for operations can be learned from "planning for special events." In particular, "planning for special events" is characterized by collaboration and an urgency of purpose or mission. Collaboration occurs between agencies and possibly between jurisdictions that may or may not normally collaborate with each other. The event or crisis creates an urgency of purpose – to save lives, to manage demand, to reduce delay, etc. A lot of "planning" is done for these situations. However, once the event or crisis has passed, the collaboration and focus of purpose generally ends until that next occurrence. However, the lessons learned in planning for the event may translate into the routine planning for operations activities for the agencies involved.

Operations has traditionally been focused on "keeping the system(s) running by implementing a variety of projects to improve travel safety, reduce congestion, or increase capacity (a.k.a. traffic flow or throughput). Given the growth that is expected to occur, the lag time in getting construction projects on-line, the complexity of the operational improvements that are implemented, and key societal trends, operations must be thought of as more than just a project

to resolve a problem. The operation of our transportation system is both a short-term project and a long-term strategy that will enable a continuous, high level of performance, under varying conditions and demands. This goes well beyond thinking of operations as just a project or a process that responds to a problem situation. To be effective in sustaining performance and efficiency as well as meeting user expectations, operations and the implementation of operational improvements need to be recognized as essential strategies for system management that must be formally and strategically planned for.

Definition and Scope of "Planning for Operations" Planning for Operations is a broad-based concept that can be defined as *the strategic thinking, manifested through a set of principles, that go into shaping, developing, managing, and evolving the policies, programs, procedures, protocols, and/or projects necessary* ***to make the elements of our surface transportation system work better and together*** *for customers across modes, functions, and jurisdictions*. Planning for Operations is visionary and performance-based. Planning for operations focuses on the principles and processes used by both system operators and planners for managing and operating the elements of our surface transportation system so that community goals and objectives (e.g. public safety, mobility, access to jobs, congestion reduction, quality of life, economic development, etc.) can be achieved.

There are some fundamental guiding principles to planning for operations:

1. Planning for Operations is based upon collaboration (interagency, inter-jurisdictional) and integration (technological and system related).
2. Planning for Operations is visionary, strategic, and continuous. The planning does not end when the operational improvement is implemented.
3. Planning for Operations is both short-term (problem-solving) and long-term (strategic).
4. Planning for Operations is based upon customer expectations and service performance.
5. Planning for Operations encompasses policy, programs, and projects that relate to or have an influence upon operations.

By incorporating these principles and the related processes into the culture of transportation institutions, operational actions become more then a project or set of improvements to solve problems. By influencing current planning and design practices with these principles and strategic thinking, operations can become a credible and important part of transportation policy, programs, and actions to achieve a wide set of community goals. With effective, strategic planning, operational improvements can be viewed as important assets and receive long-term funding to sustain high levels of performance.

Planning for operations has typically been short term in nature to address a specified need, problem, or situation. Given the growing societal, logistical, and economic demands for transportation on the part of the wide variety of users, and our inability to quickly build the needed infrastructure capacity, planning for operations must also be more strategic to ensure that system performance needs and customer service expectations are being met over a longer term. Planning for operations can ensure that the need for functionality and performance are being met, given the investments made to improve, build or even rebuild elements of the transportation system over the long-term in anticipation of growth and varying demands.

Planning for operations can address the following:

1. The long-term costs of operations,
2. Financial planning and funding (sources),
3. Information sharing (with other services and functions),
4. Integration (with other services and functions),
5. Institutional coordination and decision-making,
6. Architecture and standards,
7. Asset management (including life cycle analyses and long-range needs assessment),
8. System evolution and growth,
9. Performance measures development and use,
10. Data collection and use,
11. Development and use of customer service satisfaction indices,
12. Collaboration and information sharing opportunities,
13. Equipment needs,
14. Staffing needs,
15. Funding needs, and
16. Phased functionality and capability evolution over time.

The growing importance of better operations as an institutional philosophy means that operators and planners need to work together continuously and recognize that planning and operations are linked as functions.

Planning for Operations: Perspectives

The function and scope of "planning for operations" will look very different in an operating organization (or agency) than it does in a planning organization (or agency). Yet both the planning organization and the operating organization have important roles to play in efforts to better plan for operations. Their roles are going to depend on their designated responsibilities, institutional relationships, politics, policy expertise, and technical expertise. The following table is intended to outline some of the perspectives and interests that planning for operations will take, depending on the institutional setting and the institutional functions. (NOTE: The following table is intended for illustration only and is by no means a complete listing of activities.)

TABLE: Planning for Operations – Perspectives

INSTITUTIONAL SETTING⇒ **INSTITUTIONAL FUNCTIONS ⇓**	**State** (e.g. DOT, Police, EMS)	**Local** (e.g. DPW, DOT, transit, schools, Police, Fire, EMS)	**Regional** (e.g. MPO, Transit, Regional Organization)	**Project** (e.g. TMC, traveler information, E-911)
Operations	* Life cycle analyses * Data collection * Performance monitoring *Information Sharing *Systems Integration	* Life cycle analyses * Data collection * Performance monitoring *Information Sharing *Systems Integration	*Information Sharing *Systems Integration *Regional Concept of Operations *Performance Measures *Use of ITS Architecture	*Systems Engineering Approach *Concept of Operations
Planning	* Use of ITS Architecture * Setting Performance Measures *Conduct life cycle analyses *Facilitate collaboration *Budget and Investment Decisions	* Use of ITS Architecture * Setting Performance Measures *Conduct life cycle analyses *Facilitate collaboration *Budget and Investment Decisions	*Regional Operations Policies *Regional Performance Measures *Transportation Improvement Program *Use of ITS Architecture	*Performance Monitoring *Customer Service *Information Sharing

Why "Planning for Operations"

There are many very important reasons why better "planning for operations" is (and will be) needed to help government achieve a variety of goals. One of the first reasons is planning for operations is needed to accommodate the growth in demands, in all its dimensions, even in the face of potential infrastructure capacity expansion. Growth, both in population, number of vehicles, and economic development, has affected travel demand and re-shaped travel patterns. Growth will continue and is expected to be significant, especially in the areas of freight movements and intermodal connections. Realizing that the problems cannot be addressed solely by construction of more capacity, planning for operations can address the transportation issues created out of growth and the variability in demand for use of the systems. It is important to understand that system capacity expansion is a slow process, yet growth in demand continues at a faster pace. Some of the key growth trends that will affect the management and operations of our transportation system include the following:

1. There are over 240-million passenger vehicle on our roads - nearly twice the number that were there in 1975. The number of vehicles increased at an annual rate of about 1.5 times that of total population between 1975 and today and is expected to continue.
2. The number of trucks is also expected to increase significantly over the next 10 years as we move more into e-commerce and global trade.
3. There are many more dual income households that do a lot of trip chaining going to and from work.
4. The amount of freight moving on our roadways will double in the next 10 years.
5. Passenger and freight volume at terminals and ports (especially airports) will double over the next 10 years.

In addition to growth, there are other societal trends and events that must be recognized because they also speak to the need for better planning for operations. These trends and events will impact the manner in which the elements of our transportation system are operated and can only be understood and accommodated through planning for operations. Some of the trends and events that point to the need for better planning for operations include:

1. Information technologies are transforming the way we live and work together and the way services and products are delivered. The extent of this transformation was unimagined 25 years ago. In 1988 there were about 2 million cell phones in use in the United States. Today there are more than 82 million cell phones in use. The proliferation of information technology will continue.
2. Related to the information age is the fact that the technologies used for our transportation systems and services have tremendous potential and capabilities. As a result they are much more complex then the technology of 25 years ago. Today's technologies, particularly information technologies, are more complex and more sophisticated. Generally, they are more costly to purchase and sustain than the simpler mechanical systems of 25 years ago. If the computer within these systems fail, it may be easier and even cheaper to purchase entire new components rather then attempt a repair. Newer computerized systems become outdated relatively quickly. Planning for operations can help decision-makers understand what resources will be needed to sustain and even evolve these technologies so that operators and planner can take advantage of their full range of capabilities.
3. Addressing the problems of operating our transportation systems is now a 24 hour-a-day, 7 day-a-week function. Transportation operations go beyond just addressing the peak commuting periods. Non-work travel for shopping, recreation, etc. will continue to increase. The focus of operating our transportation systems has expanded beyond the commute focus and is addressing welfare-to-work and access to jobs, sporting and other special events, the needs of shippers and goods movement, periods of maintenance and reconstruction, periods of adverse weather, natural disasters, public safety, incidents and emergencies, shopping, recreation, and tourism.
4. Regional collaborative approaches to addressing transportation operations and system performance are becoming more accepted. These multi-agency, multi-State, and/or multi-jurisdictional approaches have occurred to address crosscutting issues such as incident management and emergency response, electronic toll and fare collection systems, traveler information systems, commercial vehicle operations, and traffic signal systems. Planning for operations is necessary for the collaborations and information

sharing across agencies and across jurisdictions that need to take place that would leading to institutional and technical integration.

5. Intelligent transportation systems (ITS) are becoming frequently used as part of operational improvements now being deployed in a growing number of metropolitan and rural areas and corridors. ITS are an important part of arterial management systems, freeway traffic management systems, incident and emergency services, traveler information systems, transit management systems, electronic toll collections and fare payment systems, and travel demand management services. The complexity of these systems and the long-term costs to keep them functioning at optimum levels are not fully realized at the time of implementation.
6. To support and facilitate the deployment of ITS, more regions are (or will be) developing an ITS architecture and using ITS standards that facilitates the integration of institutions and systems to enable the sharing of information and coordinated better system operations. A national policy on the National ITS Architecture has been developed and promulgated by both the Federal Highway Administration and the Federal Transit Administration. ITS standards for advanced systems have been developed and are now being put into practice.
7. Increased customer demands for reliability, predictability, and user-friendliness are driving the tendency for transportation decision-making to focus the attention of transportation on meeting customer (user) needs. This attention to customer service is being coupled with increased interest on developing better performance measures that reflect user satisfaction and system performance. To keep customer service satisfaction levels high, mangers of transportation systems and services are moving to a philosophy that "anticipates and manages" demand under a variety of conditions and events. Planning for operations is needed to develop, achieve consensus on, and put into practice the use of performance measures to support a customer service mission. Addressing the issues related to access to jobs is primarily related to good operations and services that must be planned for to be successful.
8. Traveler information services and systems are becoming an important part of the fabric of transportation. These systems and services are part of good operations and help to achieve the system management goals of predictability, reliability, and user-friendliness as well as improve customer (traveler) satisfaction. Planning for operations is needed to make traveler information services (locally, regionally, statewide, and nationally) effective.
9. There are a variety recurring and non-recurring events that occur in both urban and rural areas that impact operations. These occurrences include: special events, emergencies and incident response, reconstruction, and tourism. Planning for operations is critical during these times to manage demand and deliver customer services sustain a high level of performance. There is a clear need to plan operations to manage events and demands during the unexpected incidents, emergencies, and weather situations. There is also a need to plan for operations to manage events and demands that are known, e.g. tourist peaks, sporting and community events, reconstruction projects and work zones, and national or international gatherings.

Planning for operations can help to create the vision for how our urban and rural are going to operate the elements of their transportation system so that they can work better and together.

Such a vision and the supporting plan for how decision-makers can achieve and sustain that vision are critical to ensuring future funding to sustain a high-level of performance from complex operational improvements and customer-friendly services.

How to Plan for Operations: Factors and Considerations for a More Visionary Approach

Planning for operations as an activity is not necessarily new. Planning for operations is currently going on at many levels of government institutions and for many types of operational activities. The biggest problems with current efforts to plan for operations are: 1.) It is generally not visionary or strategic in it scope. It generally addresses a short-term problem, situations, or events rather then continuous quality improvement of the performance of the network and systems. 2.) It is not necessarily based upon collaboration with other agencies or organizations. For the most part planning for operations is done within the confines of a unit within an operating organization. 3.) It is does not pay attention to the way resources (e.g. people, equipment, and funds) are managed to get the most out of the investments made for operational improvements over the long-term or improvement life cycle.

As was previously mentioned, there are some fundamental guiding principles to planning for operations:

1. Planning for Operations is based upon collaboration (interagency, inter-jurisdictional) and integration (technological and system related). Collaboration and information sharing are critical keys to successful and continuous "planning for operations."
2. Planning for Operations is visionary, strategic, and continuous. The planning does not end when the operational improvement is implemented.
3. Planning for Operations is both short-term (problem-solving) and long-term (strategic).
4. Planning for Operations is based upon customer expectations and service performance.
5. Planning for Operations encompasses policy, programs, procedures, protocols, and projects that relate to or have an influence upon operations.

Given these guiding principles for planning for operations; however, three tools or procedures standout, initially, as offering approaches to realizing collaborative, long-term, and performance-based planning for operations:

The ITS National Architecture: Planning for operations is based upon collaboration and information sharing that needs to occur between agencies and possibly between jurisdictions that may or may not normally collaborate with each other. The concepts and processes embedded in the National ITS Architecture provide an approach to begin to address how this collaboration and information sharing can take place. The National ITS Architecture can provide a guide to help answer who, what, where, and how questions that are involved with coordinated and integrated decision-making within an agency or on a regional level for effective transportation system management. Much can be learned from these National ITS Architecture processes and concepts to help form the basis for development operations programs, policies, procedures, protocols, projects and strategies that embody institutional coordination and integration of systems and services.

Asset management techniques: The techniques and procedures that are embedded with asset management can provide an approach for taking a strategic view of operations and addressing

the life cycle questions that can allocate the needed resources to operations over time. Asset management is a framework for making cost-effective and long-term resource allocation decisions. The decisions are strategic rather then tactical. They are based on a wide, systems view of all the assets under the transportation agency's umbrella, and reflect an extended time horizon. An asset management approach has at its foundation technical, fact-based information for decision-making and is driven by goals, policies, and budgets. Asset management and the General Accounting Standards Boards Statement 34 (GASB-34) will be driving the investment decision on many transportation agencies in the future. Most transportation agencies that have gotten into this to date are including only capital investments as part of their asset management/GASB-34 processes. Major, complex operational improvement, especially using ITS, must be considered as assets and included in this process. The asset management processes and approaches needs to be part of planning for operations, in order to make cost-effective, long-term, resource allocation decisions for the substantial investments being made complex operational improvements. An important part of asset management, and integral to planning for operations, is life cycle analyses. It is essential in planning for operations that all aspects of the life cycle for an operational improvement, policy, or program be understood and addressed as part of investment decisions, especially over time. Only then can the longer-term resources and adjustments be made to optimize the investments being made in the operations policy, project, or program.

Performance Measures: The use of performance measure to evaluate the ability of transportation services, systems, and facilities to meet manager and customer expectations are becoming an increasingly common activity. Many different transportation agencies use performance measures to gauge their progress toward clearly identified goals on a regular basis, reporting the results, and acting upon those findings to deliver most effectively to the tax-payers. Performance measurement program share a common need for accurate and timely data, obtained without considerable cost, and easily translated into information that can be understood by and communicated to the public, elected and appointed decision-makers, and individuals who manage agencies. Identifying the measures and obtaining the data is challenging and is an important part of planning for operations.

Expectations from "Planning for Operations"

There may be many expectations that come from planning for operations. These expectations may include the following:

1. Reduced maintenance costs of operations, because the true life cycle costs of operational improvements and their upgrades are planned with appropriate resources allocated.
2. More efficient and effective use of resources within an agency, a region, or a State can be realized through information sharing and system integration.
3. More balanced investment and resource allocation decisions can be made between infrastructure and operations. Planning for operations enables sustained effective operations over the long term and reduces duplication for similar capital investment services in the future by another agency or jurisdiction. Investment decisions recognize the life cycle needs and allow for growth and evolution of better operations.

4. More appropriate decisions about when, where, and how information sharing and system integration both interagency (e.g. between county police, traffic, schools) and inter-jurisdictionally (e.g. between two or more counties) can take place.
5. Customer service needs can be understood because of the development of accepted performance measures and the development of ways to collect the data to support the measures.
6. Improved system reliability can be realized with the associated measures of performance.
7. Improved ability to detect and respond to unexpected incidents, emergencies, and conditions.
8. Traveler information services that are easily accessible, reliable, and informative so that commuters, shippers, truckers, tourists, public safety professionals (police, fire, EMS) shoppers, and sports fans can have a better quality of trip – one that is more predictable.

"Planning for Operations": A Final Thought

"Planning for operations" is becoming essential today and in the future because operations is now a complex science and the demands by users of the transportation systems and service have grown substantial. Advanced technologies and intelligent transportation systems are being deployed in both urban and rural settings to improve operations and system performance, for the system managers and for the travelers. These complex systems demand strategic planning in order to realize their capabilities and full functionality over time. Given that significant investments are made in technology, planning is needed to identify user requirements, shape a concept of operations, and realize full functionality of these systems, over time.

If we are to achieve a higher vision for the way we want our transportation systems, services, and facilities to operate, a more formal and functional approach to planning for operations is needed. This type of planning for operations answers questions about meeting user expectations and how to realize the full functionality and capability of what are now more technologically complex systems. Sustaining and/or improving upon the high-level of functionality for the significant investments made in these systems can only be effectively achieved through strategic thinking – the purpose of "Planning for Operations."

Institutional Challenges, Barriers and Opportunities: Institutional Integration

White Paper for ITMS Conference (July, 2001)
By Louis Neudorff
Siemens – Gardner Transportation Systems

In a pluralistic society such as the United States, the transportation network within a metropolitan area or region – consisting of arterial streets, expressways, bridges and tunnels, and transit facilities – undoubtedly crosses numerous geographic, political, and institutional boundaries. As a result, there is typically a large number of transportation agencies (both public and quasi-public) and other entities that are involved in or somehow impacted by the operation and management of this transportation network. Per the definition included in the conference announcement, an Integrated Traffic Management System (ITMS) provides for the "real-time sharing of information between ITS-based systems and the coordination of management activities between transportation agencies". For an ITMS to become a reality, these numerous organizations must first agree to share information and to coordinate with one another. Subsequently, they must identify what information will be shared and how it will be utilized; define how the information will be exchanged (e.g., communications and system interfaces); determine the level and extent of their inter-agency coordination (e.g., shared control of field devices), and under what circumstances this coordination is initiated; commit the necessary resources to implement, operate, and maintain the ITMS; and develop the necessary inter-agency agreements (and possibly legislation) documenting the various ITMS agreements, policies, and procedures. This can be a daunting and often frustrating task, with a significant amount of time and effort directed towards overcoming a multitude of institutional barriers and challenges.

Institutional Barriers and Challenges

What are some of these institutional barriers? Perhaps foremost is a sort of "institutional inertia." For years, the concept of "transportation management" was concerned primarily with the design, construction, and maintenance of infrastructure, be it new roadways, transit facilities and rolling stock, or traffic signals. Such projects could be (and generally were) successfully undertaken in relative isolation.[1] Intelligent Transportation Systems (ITS) represents a new paradigm in which the focus has shifted from the infrastructure proper, to operation of this infrastructure and the entire transportation network as a whole. It is a relatively new way of thinking – this concept of using computers and electronics to improve traffic flow with little steel or concrete, coupled with the need to coordinate your operations with other entities – to which senior management and the institutional framework within many organizations may not have completely adjusted.

Other potential institutional challenges exist. It is natural for individual transportation entities to be motivated first by their own operational concerns and needs. It is not uncommon for state and

[1] One exception is worth noting. The Port Authority of NY/NJ, which operates the Hudson River Crossings between New York City and New Jersey, became concerned about the construction and maintenance activities (and incidents) in the vicinity of their facilities. This regional view and their leadership led to the creation of the TRANSCOM coalition.

local governments to have a rather contentious relationship, be it about funding levels, their respective responsibilities and levels of authority, schools, transportation, etc. ITMS typically requires that "new" players (e.g., enforcement agencies, emergency service providers, private information service providers) be brought into the institutional mix, and there may be a certain amount of cautionary discretion at first, and possibly misunderstandings. Legal considerations and constraints can play a significant role, particularly if some form of "joint" control of ITS devices or combined staffing of an operations center is being considered for the ITMS.

Institutional barriers can also exist within an individual agency. Different departments within the same agency (e.g., operations, construction, financial) will likely have roles to play within an ITMS; but they may also have overlapping responsibilities, a lack of understanding of the other departments' missions, and conflicting priorities and policies. An agency may oversee multiple, geographically separated transportation facilities within the same region (e.g., tunnels and bridges), where the day-to-day management and operations of these individual facilities has historically been relatively independent from one another. These intra-agency barriers can prove a greater hindrance to an ITMS than the inter-agency challenges, particularly if senior management within the agency do not understand (or accept) the importance of and the need for ITS and integration.

ITS Architecture and Institutional Considerations

The ITS National Architecture utilizes a layered framework consisting of three layers—transportation, communications, and institutional. The transportation and communications layers are "technical" layers in which the actual components reside. The institutional layer is a non-technical layer that establishes the policies, funding incentives, working arrangements, and jurisdictional structures that support the technical layers. The importance of the institutional layer cannot be overstated. It is probably the most important in terms of actually getting ITS-based systems funded and deployed, providing the necessary (and on-going) operations and maintenance of these systems, and implementing the organizational arrangements that support the information sharing and interagency coordination within an ITMS.

From an institutional coordination perspective, the National ITS Architecture helps local transportation planners to identify other stakeholders who may need to be involved and to identify potential integration opportunities. Information flows and process specifications are defined in the National ITS Architecture, allowing local transportation agencies to accelerate the process of defining ITMS functionality.

An ITMS (and the concomitant sharing of real-time information and coordination of operations between multiple transportation agencies) requires a *Regional ITS architecture*, which is defined in a recent FHWA rule (Reference 1) as "a regional framework for ensuring institutional agreement and technical integration for the implementation of ITS projects or groups of projects". The regional ITS architecture must fit within the existing organizational infrastructure. It is unrealistic to demand significant changes or attempt to impose a new institutional framework on the various agencies and entities who are involved or affected by ITS, other than to build logical extensions to the existing framework and have it evolve over time. In other words, the ITMS must be developed to function and provide optimum benefits within the

institutional constraints and barriers. At the same steps can and should be taken to eliminate some of these barriers or minimize their impact.

Regional Architecture Requirements

A final rule (RIN 2125-AE65), developed by FHWA and published on January 6, 2001 (Reference 1), implements section 5206(e) of the Transportation Equity Act for the 21st Century (TEA– 21), enacted on June 9, 1998, which required Intelligent Transportation System (ITS) projects funded through the highway trust fund to conform to the National ITS Architecture and applicable standards. This rule requires that the National ITS Architecture be used to develop a local implementation of the National ITS Architecture, which is referred to as a "regional ITS architecture". The rule states that "the regional ITS architecture is based on the National ITS Architecture and consist of several parts including the system functional requirements and information exchanges with planned and existing systems and subsystems and identification of applicable standards, and would be tailored to address the local situation and ITS investment needs."

The rule addresses several of the institutional issues associated with an ITMS. Specifically, it states that "regional ITS architectures be based on established, collaborative transportation planning processes" The rule further states that "successful ITS integration and interoperability require addressing two different and yet fundamental issues; that of technical and institutional integration...*Institutional integration* involves coordination between various agencies and jurisdictions to achieve seamless operations and/or interoperability. In order to achieve effective institutional integration of systems, agencies and jurisdictions must agree on the benefits of ITS and the value of being part of an integrated system. They must agree on roles, responsibilities, and shared operational strategies. Finally, they must agree on standards and, in some cases, technologies and operating procedures to ensure interoperability. ... This coordination effort is a considerable task that will happen over time, not all at once. Transportation organizations, such as, transit properties, State and local transportation agencies, and metropolitan planning organizations must be fully committed to achieving institutional integration in order for integration to be successful. The transportation agencies must also coordinate with agencies for which transportation is a key, but not a primary part of their business, such as, emergency management and law enforcement agencies. Successfully dealing with both the technical and institutional issues requires a high-level conceptual view of the future system and careful, comprehensive planning."

Addressing Institutional Challenges

How do those transportation professionals interested in developing or expanding an ITMS address these institutional constraints and barriers? A Draft State-of-the-Practice Review of Highway Traffic Operations (Reference 2) states that "a number of barriers and institutional issues have restricted agencies from proactively managing travel and controlling traffic in a manner that meets the real-time needs of its users. To address and overcome these challenges, a fundamental change in the culture of public agencies is needed to plan for the future, and conduct business on a day-to-day basis. To accomplish these changes will require all agencies in a region to participate and collectively plan for the future, allocate resources, make investment

decisions, implement initiatives, and strategies aimed at optimizing the performance of the highway network."

The need for all agencies, or "stakeholders" to participate in the planning and development of a Regional Architecture and ITMS is also emphasized in the recent FHWA rule and in other documents (References 3 – 5). The FHWA rule states that "provision should be made to include participation from the following agencies, as appropriate, in the development of the regional ITS architecture: highway agencies; public safety agencies *(e.g.,* police, fire, emergency/medical); transit operators; Federal lands agencies; State motor carrier agencies; and other operating agencies necessary to fully address regional ITS integration." Other entities to be considered include the MPO's, the media, traveler information service providers, and disaster management interests, and their respective needs for information.

A case study on the development of the Regional ITS Architecture / Regional ITS Integration for the NY-NJ-CT region (Reference 3) emphasizes the need to involve as many organizations as possible in the process; that early establishment of interagency communications and relationships is the key to success in the regional ITS architecture development process. Bringing together all the stakeholders can serve to cultivate an interest in regional ITS solutions, increasing the agencies' understanding of the importance and need for ITMS. The various participants can identify and focus on common goals, leading to the development of an ITMS concept that will satisfy these goals. Moreover, it allows each entity to understand the specific functions and perspectives of their partner agencies, as well as their respective institutional constraints and barriers, thereby making the collaborations more productive (i.e., developing a regional architecture and ITMS that can actually be implemented within the institutional framework).

What impetus is there for getting all the affected agencies and entities together to discuss regional ITS integration in the first place? The recent FHWA rule – tying Federal funding for ITS projects to the establishment of a Regional ITS Architecture, and conformity of these projects with that architecture – will certainly be helpful in this regard. Nevertheless, an "ITMS champion" is essential to take the lead in this endeavor, to arrange and organize inter-agency meetings, and continuously promote the need and benefits of regional ITS integration. This champion may be the MPO, a "regional" transportation agency, or a State DOT. Obviously, the ITMS champion must function as an advocate. At the same time, however, this lead agency must be careful that it is not viewed by the other entities as using the ITMS concept as a means to expand its own influence and control.

A related issue is the organization and structure by which the participating agencies and other stakeholders actually meet to discuss institutional and technical issues associated with developing and operating an ITMS. In general, the last thing any transportation professional or manager wants is "another committee". Using existing institutional mechanisms to promote these regional discussions (e.g., MPO meetings, ITS / EDP project status meetings) is the preferred approach.

This institutional framework for developing the Regional Architecture and ITMS is merely a means to an end. The planning process includes several activities that will be influenced by institutional considerations and constraints in some fashion, including:

- Defining the "region". The aforementioned FHWA rule (reference 1) states that a "*Region* is the geographical area that identifies the boundaries of the regional ITS architecture and is defined by and based on the needs of the participating agencies and other stakeholders. In metropolitan areas, a region should be no less than the boundaries of the metropolitan planning area."

- Identification of any additional agencies and other stakeholders that should be participating, and the interconnections between their individual goals and those of the ITMS.

- The functional requirements of the ITMS. The overall functionality of a regional architecture may be described in terms of Market Packages as defined in the National ITS Architecture, such as Regional Traffic Control (ATMS7), Multi-modal Coordination (APTS7), and several Traveler Information Market Packages.

- An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the implementation and operation of the ITMS. For example: what information does each agency have / will have; what information will be shared and how it will be utilized; the level and extent of inter-agency coordination (e.g., shared control of field devices, joint staffing of a regional operations center), and under what circumstances this coordination is initiated.

- Analysis of alternative system configurations and technology options to meet requirements. While this is primarily a technical consideration, institutional issues can play a significant role, particularly regarding the overall physical architecture. For example, the ITMS functions and processing may be distributed over multiple agency – specific traffic operations centers; centralized in a separate ITMS clearinghouse / operations center with connections to individual agency operations centers; or housed in a single regional control center which also manages the agency-specific facilities using staff from multiple agencies. Such a determination is as much an institutional issue as it is a technical one.

- Identification of the financial and staffing resources necessary to implement, operate, and maintain the ITMS, including the initial development and recurring updating of the ITMS operating plans and procedures. Also identification of the sources for the required funding and staff (e.g., Federal funding, allocations from the various agencies, consultants / contractors, public-private partnerships, some combination).

- Any inter-agency agreements (existing or new) and policies required for ITMS deployment and operations.

- ITMS procurement procedures (e.g., approach, contracting entity)

Even after the ITMS has been constructed and commenced operations, the institutional issues will still play a significant role. The system can be expected to evolve over time. As the participating agencies see the benefits of regional integration, it is quite possible that incremental

enhancements in the ITMS functionality will be implemented. This, in turn, will require modifying the institutional agreements, operating policies, and the staffing requirements. Additionally, on going hiring and training of new staff (replacement or additional) can be expected throughout the life of the ITMS.

Intra-Agency Barriers

The discussions above focus on the institutional challenges and opportunities associated with inter-agency coordination in developing an ITMS. Agencies don't attend and participate in ITMS planning meetings, per se; rather, it is their representatives that discuss and (hopefully) resolve the numerous institutional and technical issues associated with regional integration of ITS. And while these participants might fully understand the importance and need for an ITMS, they still must translate the potential benefits and justify the potential costs to their respective organizations.

Reference 3 (Case study on the development of the Regional ITS Architecture / Regional ITS Integration for the NY-NJ-CT region) identifies the need for *inreach* to enable the individual agencies to buy into the concept of a regional ITS architecture and ITMS. This education and inreach effort can be accomplished in many ways – for example, interviews of agency staff during the ITMS planning process, seminars and design charettes, and the creation / expansion of a "Regional Executive Group" or advisory subcommittees focusing on specific ITMS issues. The interest and involvement in ITS must be at all levels – operations, planning, maintenance, budgeting, and senior management. The senior management may be the most important in this regard, as they have the authority to direct resources towards the development of ITS systems and a regional ITMS. They are also the ones who will ultimately approve and execute any inter-agency agreements.

Public – Private Partnerships

Inter- and intra-agency relationships (i.e., "public – public partnerships") are obviously crucial in developing, deploying, and operating an ITMS. Nevertheless, it is almost certain that private sector entities will play a significant role in the ITMS process. For example, over the last few years, private entities have become more involved in providing ITS-related services to the public, particularly in the collection, integration, and dissemination of traveler information. The deployment of an ITMS will typically result in a database of real-time information on traffic and transit conditions throughout the region, and this regional database may be of some value to these Information Service Providers. Moreover, the ISP's may already be collecting information that is beneficial to the ITMS.

A public – private partnership may be formed as a means to reduce the public agency costs associated with an ITMS (as well as possibly the costs of the individual ITS-based systems comprising the ITMS) and / or to accelerate the deployment process. Within the context of an ITMS, a public – private partnership can be viewed as an arrangement whereby a private entity provides some or all of the services and components required for an ITMS; but instead of receiving direct reimbursement from the public agencies (i.e., a traditional fee – for – services contract), some or all of the private entity's costs for these services are recouped by "selling"

some of the ITMS attributes to other private entities, or by receiving a non-monetary consideration from the public agencies – a sort of quid-pro-quo. Some of the potential public – private partnerships that might be considered for an ITMS, and the associated institutional issues and barriers, include:

- Charge a fee to private entities (e.g., Information Service Providers) for accessing the regional ITMS database of real-time information on travel conditions. Another alternative, in lieu of an access fee, is for the public agencies to receive a portion of any revenue earned by the private entities for the "resale" of the ITMS information. Some of the issues to be addressed include the value of this information to the ISP's (many of whom may have already developed their own sources of information), and how the information might be priced; the degree to which any ITMS information is provided for "free" (e.g., individual agency web sites), and how this free dissemination of information affects the value and pricing mechanisms for the ITMS database; and any rules and restrictions regarding the use of the ITMS information for both the public sector and private entities.

- Turn over the deployment and / or operation of the regional architecture / ITMS to a private entity. Responsibilities and functions of the privatized ITMS could include accessing and integrating transportation information from multiple public agencies, providing the information clearinghouse and coordination support for the public sector entities, and operating and maintaining the ITMS. Such services might be provided at little or no cost to the public sector. In return, the private entity would be given exclusive rights to the public sector information under some sort of franchise agreement, and could market information dissemination services directly to the traveling public and / or sell the information to other private entities. In addition to the issues identified in the previous bullet, this approach must also address questions such as how the franchise is awarded and renewed, public agency oversight of the franchise, and (assuming that most of the ITMS clearinghouse information comes from the public agencies and their transportation management systems) compatibility between the "exclusivity" of the franchise arrangement and freedom of information statutes.

- Providing access to the transportation right–of–way to a private entity for the installation, operation, and maintenance of individual agency system and ITMS elements. One example of this approach is the communications network as was done in Minnesota. Under the "Connecting Minnesota" public – private partnership, the state allowed a communications network developer limited access to interstate rights-of-way. In return, the private entity was to completely finance, build, and operate a statewide fiber optic communications network covering 2200 miles, bringing the telecommunications infrastructure to rural areas and small towns throughout the State. The private developer was to reserve 20 percent of the network for public sector use, and selling the remaining 80 percent capacity to long distance, Internet, and other telecommunications service providers. Work commenced in 1998. However, a telephone company and the Minnesota Telephone Association filed a suit challenging the state's legal authority to pursue the project. A County District Court dismissed the lawsuit in May 1999, and the Minnesota Supreme Court denied a subsequent petition to review the

District Court's ruling. However, in February 2001 – the original scheduled completion date – the State terminated the agreement after 250 miles of an operable point-to-point network had been installed. The state project director stated "a major build-out is not possible at this time. Legal and regulatory challenges have been time consuming and delayed the project. Market erosion over the past few weeks has impacted the telecommunications industry and added to the uneasiness" (Reference 6).

- Another example of providing right-of-way access is Trafficmaster in the United Kingdom. In May 1990, the Department of Transport granted a license for Trafficmaster to install a pilot traffic detection scheme. After successful evaluation of the pilot scheme, a 12-year license was granted covering all motorways and trunk roads in England. The Trafficmaster network of 7500 sensor sites now covers over 8000 miles of the UK mainline road network. The data is provided to the Department of Transport to aid in their traffic management responsibilities; but ownership of the data rests with Trafficmaster, which converts this proprietary content into average speeds, delays, and journey times, and communicates the information to its customers in a variety of ways (e.g., in-vehicle devices, mobile phone, internet).

In any public – private partnership, there must be a well-defined allocation of responsibilities, and risks between the public and private sectors. Moreover, these respective roles and levels of involvement may change over the life – cycle of the project. Another consideration is how the project is financed. For many of the examples noted above, most, if not all, of the project funding was private, with the public sector involvement being in a regulatory / oversight or initial concession – granting capacity. Under current law, the Internal Revenue Code limits the extent to which a private concessionaire may be employed on a project seeking to access a tax-exempt bond market (Reference 7). However, there are mechanisms by which the lower-cost tax-free financing may be obtained for a public – private partnership, such as special purpose public agency or a nonprofit corporation authorized under IRS revenue ruling 63-20. (Note – An in-depth discussion of these and other innovative financing options is beyond the scope of the ITMS conference.)

An article in "FHWA's Innovative Finance Quarterly" (Reference 7) concluded, "Public – private partnerships can take on a variety of forms. No one technique is inherently superior to another. Rather, the optimal approach will vary from project to project, depending on project specific facts and circumstances. In some instances, the structure is driven by State law, based on enabling legislation. In other cases, it relates to how private participation can be used in combination with tax-exempt debt issuance. In yet other cases, public policy objectives (degree of risk aversion, desires to be actively involved, etc.) may be the driver."

Human Relations

The process of identifying and resolving the numerous institutional and technical issues associated with an Integrated Traffic Management System requires the talents of many people. In fact, most institutional challenges and barriers are really about human relations. As stated in the FHWA "Guidelines for Successful Systems" (Reference 4), "excellent human relations are therefore essential to a systems success. In fact, this may be the most critical aspect of the process. If the various participants cooperate, then a successful system is almost assured. On the

other hand, when the relationships between individuals disintegrate and they start to work at cross-purposes, the success of the system (ITMS) is seriously endangered."

The dependence on the social behavior of different individuals can be a bit unsettling. After all, the most critical element of the ITMS process is also the least controllable. Reference 4 identifies a number of general principles that can help to promote and maintain good human relations, and therefore minimize many of the institutional barriers. These principles include:

- Good communications, preferably face to face.
- Appropriate knowledge and authority on the part of key individuals (agency representatives, managers)
- Empathy – viewing problems and issues as others do, which requires careful listening.
- Honesty – clearly presenting the facts and being truthful in all dealings.
- Individuality – approaching people as individuals, not as stereotypes.
- Thoughtfulness – showing respect for the opinions and talents of others.
- Positive Thinking – showing confidence in the concept of an ITMS
- Flexibility – recognizing that circumstances change, and being open to new ideas.

At the same time, the formal elements of the process (inter-agency agreements, memoranda of understanding, contracts) must be developed in a careful and thorough manner. Should human relations break down at some point, the existence of such documentation becomes even more critical.

Summary

Summarizing some of the key points herein: the process for developing and deploying an ITMS must address all sorts of institutional interactions – between transportation agencies, within each of these agencies, and between the public and private sectors. The ITMS must fit within these existing organizational infrastructures. It is unrealistic to demand significant changes or attempt to impose a new institutional framework on the various agencies and entities who are involved or affected by a proposed ITMS, other than to build logical extensions to the existing framework and have it evolve over time. In other words, the ITMS must be developed to function and provide optimum benefits within the institutional constraints and barriers. At the same steps can and should be taken to eliminate some of these barriers or minimize their impact.

The ITMS institutional arrangements can take on a variety of forms. No one technique or process is inherently superior to another. Rather, the optimal ITMS arrangement will vary from region to region, depending on project specific facts and circumstances. Nonetheless, the processes and the resulting ITMS will have a few things in common – they will have engaged all the entities and stakeholders that might be affected by the ITMS in meaningful discussions, they will have champions in senior management levels, and they will have been relentless in achieving the goal of an ITMS.

References

1 - Federal Register / Vol. 66, No. 5 / Monday, January 8, 2001 / Rules and Regulations
DEPARTMENT OF TRANSPORTATION, Federal Highway Administration
23 CFR Parts 655 and 940, [FHWA Docket No. FHWA–99–5899]
RIN 2125–AE65
Intelligent Transportation System Architecture and Standards

2 – "Highway Traffic Operations and Freeway Management: State-of-the-Practice Review" (Draft); Jon Obenberger, Office of Travel Management, FHWA Operations, CBU
December 6, 2000

3 – "Regional ITS Architecture Development: A Case Study, New York – New Jersey – Connecticut Region: Building a Framework for Regional ITS Integration"; FHWA: September 1999

4 – "Guidelines for Successful Traffic Control Systems"; Louis Neudorff; FHWA-RD-88-014
August 1988

5 – "Incorporating ITS Into the Transportation Planning Process";
Slide presentation for NCHRP 8-35 (Project Summary & Guidebook Overview)

6 – Various News Releases from the Mn/DOT web site.

7 – "Space, Time, and Public-Private Partnerships"; Bryan Grote & David Seltzer; FHWA's Innovative Finance Quarterly; Fall, 1998

Strategies to Design an ITMS

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In considering the challenges of initiating a design process related to ITMS, a wide breath of potential considerations are worthy of consideration. As would be expected these issues will vary from case to case depending on the specific dynamics of the project in consideration. The objective of this paper, then, is to establish a framework to assist in the process of capturing issues relevant to the design process in general and to further define these issues to address the breadth of variables which are due attention in order to bring suitable containment for the proper definition of design specific requirements.

A common misconception in initiating a design exercise for ITMS is that design specific activities are the first horse out of the gate. It is argued that there are at least a couple of significant stages of work that need attention prior to initiating even the first of design activities. For the purpose of this discussion the following major groupings of activities will be examined:

- Scoping Phase;
- Deployment Planning Phase;
- Design Phase;
- Implementation Phase (not addressed in this paper)
- O&M Phase (not addressed in this paper)

In addition to the foregoing there is a rapidly growing area of consideration, which the vast majority of past traffic control, type applications have not in the past needed to address in a strategic fashion. This emerging issue focuses on the co-existence and/or the integration of the ITMS application with control agencies' perspectives related to enterprise wide Information Technology (IT) activities. Accordingly, a section is included with this paper to address this matter.

1.0: Scoping Stage

One of the more common pitfalls for an integration project falls into is not strategically addressing where and how the project fits into the big picture of ITS integration at a regional level. All too often design activities are immediately initiated and the question of where the project fits into the big picture is not seriously addressed until some other similar integration project is initiated in the same region leading to the rather obvious question, "will these two initiatives talk to each other" or until some higher authority asks the question "will this be a standard" for future efforts"?

The framing of the project into the perspective of the regional effort does not necessarily need to be an overwhelmingly large task provided there is some parallel or planned effort to drive out

consensus for short, medium and long term ITS deployment strategies in conjunction with the definition of a regional architecture. Rather, it can sufficient if the ITMS effort is able to identify with and characterize itself as part of one of the following scenarios:

- Stand-alone effort: In this scenario the ITMS is envisioned as a one time effort where the results are to likely intended to either test and/or demonstrate the potential of the ITMS concept. In this case the stakeholder group is quite small most likely limited to the agency personnel involved in the effort. While the results in this scenario are likely intended to lay the groundwork for future efforts the technical approach is not intentionally designed for broad, repeated use. The attraction of this particular scenario is the limited amount of consensus efforts needed during the development of the program and the relatively small amount of technical requirements that need to be addressed. The danger of this scenario, however, is the potential of a decision being made, well into design, that the project will indeed become some form of defacto standard for future efforts this spiraling the design into the difficult process of attempting to retro-fit consensus of new stakeholders to the technical development achieved by a relatively small number of technical specialists as well as the very real potential that the technical development is not necessarily extensible for broader enterprise application. Classic examples of this scenario are recalled in the Field Operational Test (FOT) program in recent history.

- Incremental piece of a larger ITS vision: In this scenario the ITMS is viewed as an incremental step towards the realization of the larger ITS vision. The technical development of the ITMS would by necessity need to adopt the relevant technical and operational standards engineered as part of some other over-arching regional architecture effort. The consensus efforts during the development of the project are increased over the previous scenario in that stakeholders from entities of the regional efforts that might desire to adopt the technical products produced, as part of the ITMS would need to be engaged. In addition to the extra consensus efforts, there is a potential that the ITMS application may have additional or different technical requirements that make the direct assumption of technical and/or operational standards from the regional effort difficult. This is particularly true when the ITMS is the first implementation of a paper architecture produced by others. In cases where changes are needed to the technical aspects of the regional architecture, the additional efforts associated with working through the regional change management process (assuming such a process exists) must be recognized and planned for. As a final note to this scenario, it is suggested that by virtue of review of many of the ITS early deployment or strategic deployment planning studies conducted around the nation, insufficient technical and/or operational detailed are developed to feed into an ITMS technical design process. The ITMS would then need to take into account the need for such development and plan resources accordingly should the implementation team deem themselves to be associated with this scenario. Examples of this type of approach can be found in the definition of "early winners" associated with many of the planning exercises around the nation.

- Overall architecture development with an initial implementation: In this scenario the ITMS would be the first implementation of the regional plan. On the assumption that the regional plan did not contain a detailed architecture, the ITMS effort would need to

articulate a complete technical architecture for *all modes and all roads* identified in the regional ITS deployment plan. Such an effort would involve a significant and results oriented consensus management plan in order to bring a broad and diverse group of stakeholders together around a common technical approach. Once the architecture is in place the ITMS team then would focus on the implementation of that architecture for the integration of signal systems with freeway management systems. Examples of this form of deployment can be found in the four priority corridors and the MDI exercises.

- The whole enchilada: In this scenario the ITMS is but one subsystem of a much broader intermodal, inter-jurisdictional system which is intended to build the entire regional ITS vision in a single effort. As this approach is rarely (if ever) adopted an extended discussion in this paper has been excluded.

The scoping stage of an ITMS project is also recommended to begin the process of defining the operational model for the integrated system. While specific operational procedures will need to be development in conjunction with more detailed design efforts it has been found to be extremely useful to provide enough descriptions of different alternatives associated with roles and responsibilities early in the process to avoid subsequent design sessions from being dominated by discussions rooted in operational uncertainties.

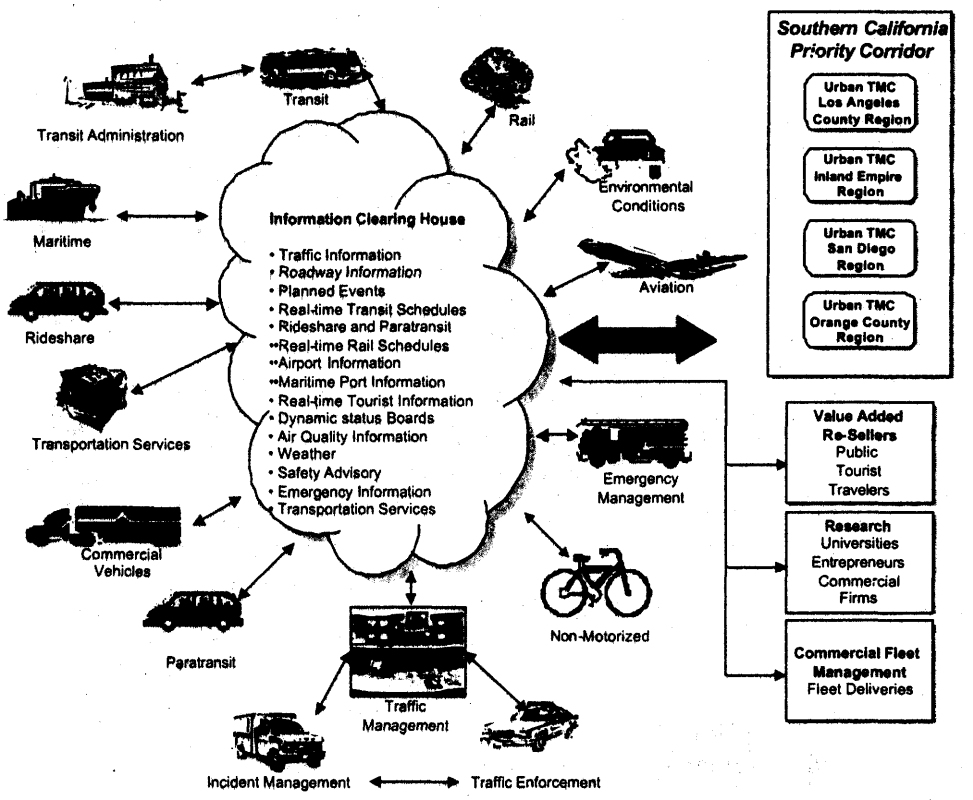
By way of illustration, a project in Southern California referred to locally as "Showcase" fell into the third scenario noted above and was charged with the development of an overall architecture with a rather limited initial deployment. The following provides a brief summary of the scooping activities that were undertaken to fit Showcase into the big picture

Scoping Showcase

The Showcase project can be thought of as the "enabler" of Southern California ITS. It applies wide-area integration technologies to intermodal transportation management and information systems, demonstrating the efficiencies gained through coordinating freeway and arterial operations in the Southern California ITS Priority Corridor. The Southern California ITS Priority Corridor, referred to as the Corridor, spans from Ventura County through Los Angeles, Orange, Riverside, San Bernardino, to San Diego County at the US/Mexican international border. This corridor is one of four identified under the Intermodal Surface Transportation Efficiency Act (ISTEA) that has moved beyond ITS limited tests and activities into "showcasing" the deployment of ITS.

The Southern California Priority Corridor Steering Committee provides a forum for the development and implementation of the Showcase Project. The membership of the Steering Committee represents a variety of governmental organizations such as, the Federal Highway Administration (FHWA), California Department of Transportation (Caltrans), California Highway Patrol (CHP), Southern California Association of Governments (SCAG), San Diego Association of Governments (SANDAG), San Bernardino Association of Governments (SANBAG), South Coast Air Quality Management District (SCAQMD), county transportation commissions, transit operators, other regional transportation agencies, and cities.

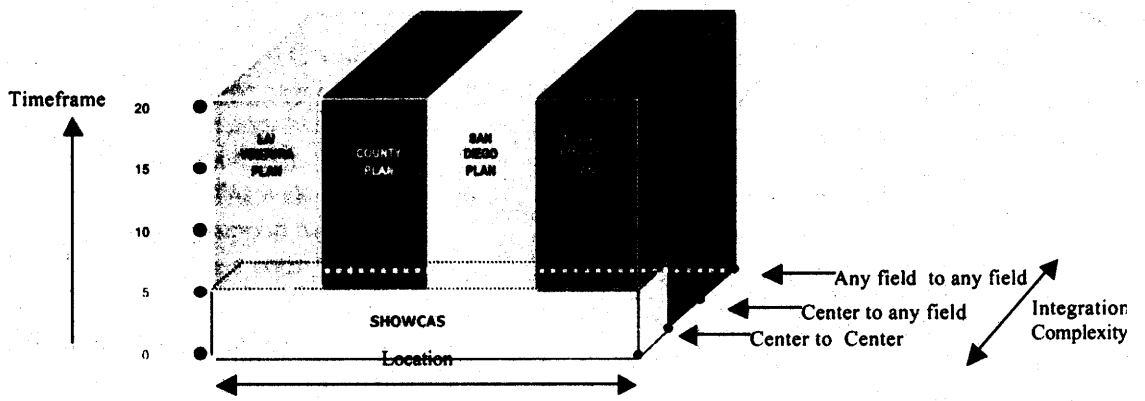
Showcase Vision



The Showcase vision is the integration of all modes and roads into a "system of systems" that continually improves the regional mobility as new ideas are built upon the Showcase foundation. This foundation relies heavily on the National Architecture, the Center-to-center (C2C) standards, and peer-to-peer relationship between centers. Therefore, the Showcase foundation empowers transportation centers to share resources with the Corridor without compromising normal operations with its local infrastructure. Sharing information and device control within the Corridor is the essence of interoperability for the Showcase project. Through the use of Showcase's interoperability, freeway, arterial, bus rail, emergency, sea/air, and commercial vehicle operations can be coordinated for unprecedented functionality and flexibility.

Showcase provides for the initial integration of the corridor, as well as the foundation for future ITS deployments on a corridor-wide basis. It represents a five-year building block upon which the full-term (20 years) roll out in the corridor is based. The Showcase initiative includes seven "Early Start" projects that are from the four regional early deployment plans. These projects which include: TravelTIP, Mission Valley Stadium ATMIS, Intermodal Transportation Management and Information System, Transit Management and Information System, Computer Aided Dispatch Integration, IMAJINE, Mode Shift, and Corridor wide deployment.

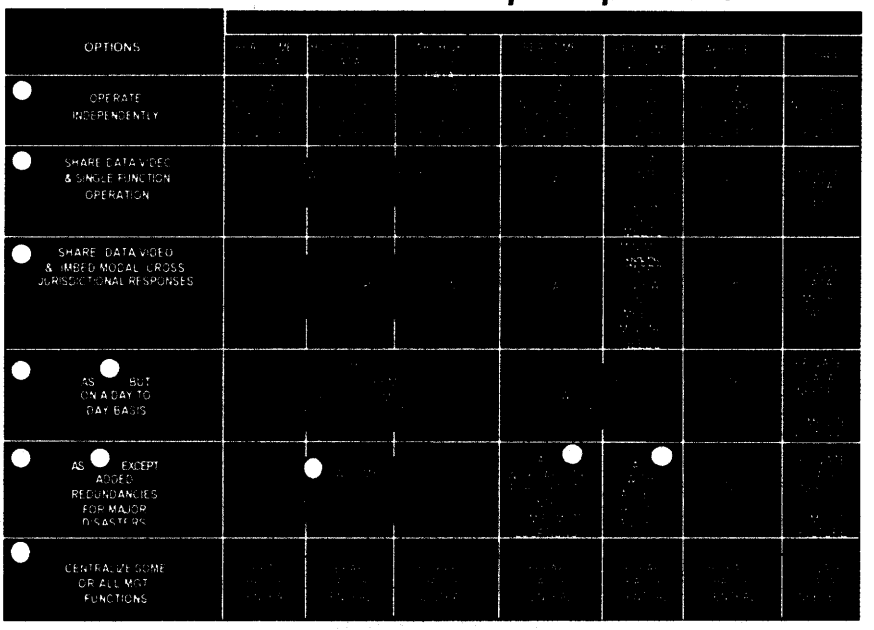
Showcase relationship with planning projects



The model adopted for Southern California (illustrated above) associates timeframe of deployment (x axis) with location of deployment (y axis) with the technology component addressed in terms of integration complexity (z axis). The latter address the technology equation in terms of incremental steps in integrating ITS technologies. The first step would be integrate management centers, the second to integrate any management center with any fielded technology and the third allowing any fielded technology to communicate with any other fielded technology. It was determined that showcase would concentrate on the first five years of deployment, across the entire corridor with a focus on center-to-center integration. The four Regional Plans, the CVO/International Border Plan, and the Corridor-wide Plan then were delegated the responsibility for determining mid to long term deployment priorities and when (or if) additional steps in integration complexity are needed

In addition to the regional plans, a Concept of Operations was prepared to document the consensus views among stakeholders on transportation management strategies and the range of interagency coordination. The Concept of Operations delineates six levels of possible interaction, from the lowest to the highest involvement:

Showcase Concept of Operations



1. *Operate independently*
2. *Share data / video on "view only basis"*
3. *Share data / video control during special events*
4. *Share data / video control day-to-day*
5. *Share control during emergencies*
6. *Centralize some / all functions*

Stakeholders agreed that each agency would be allowed to choose the level, between 2 and 5, at which they wish to participate in Showcase. FHWA impressed upon the stakeholders the need for integration beyond Level 2, considering the need to interoperate on the large Southern California infrastructure base. Level 6 was considered unnecessary given that all agencies involved believed that distributed functionality was more advantageous than a centralize regional center.

2.0 Deployment Planning Stage

With a reasonable understanding of where the ITMS project fits into the big picture, attention can focus on more technical matters. Prior to initiating a design process, however, it is advisable that a conceptual model be established for the deployment of the ITMS integration technology in order to sideline any concerns on the part of one (or more) of the agencies involved that the ITMS is going to replace their existing systems investment (unless so desired by the agency), require their operational staff to perform redundant duties in order to operate both systems or put at risk the day to day operations of their system while some other agency is in the early stages of integration with the ITMS network . In considering the deployment strategy one of the following scenarios will apply:

- *All legacy systems: In this scenario the project must integrate the operations of existing legacy systems (without substantial modification to any particular system) that more*

often than not are fundamentally different at a technical level. The focus in this instance will most likely turn to some form of middleware which would serve the purpose of abstracting the uniqueness of each system, provide a common set of protocols to facilitate data and control exchange and integrate with the existing applications in a non-intrusive fashion. The key to success will lie in the ability to establish an integration target which is separate from any of the legacy systems in order to establish the integration environment, and test the bridges to the legacy systems without risk of interfering with the day to day operations

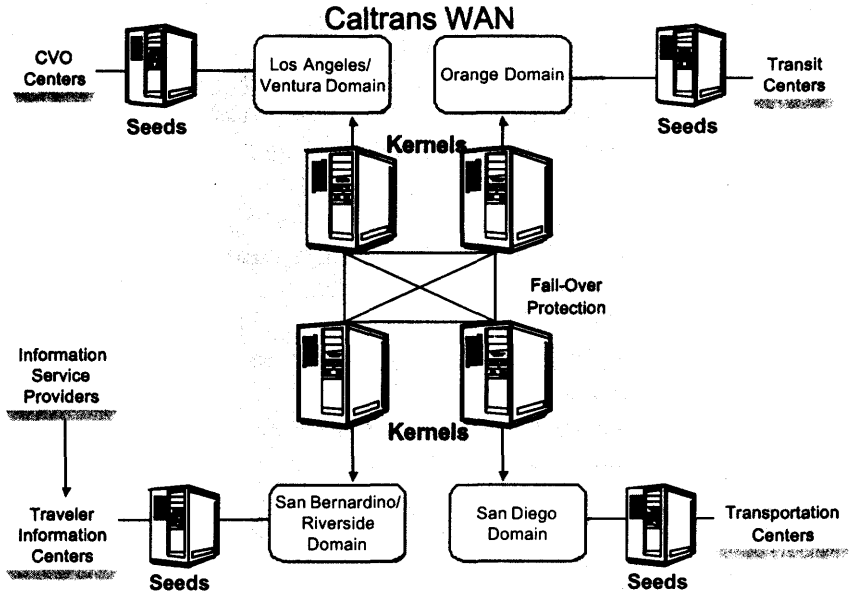
- *A mix of new systems and legacy systems: In this scenario the ITMS will be made of new a system (for example a new freeway management system by the State DOT) and legacy systems (for example a signal system installed by a jurisdiction just a few years earlier). In this instance middleware will likely still figure prominently although there will be an opportunity to build the new system on the same architecture foundation as that of the integration or middleware technology. In this scenario, the opportunity would exist to have the new system perform the task of both the mode application (freeway management in our example) and the integration task with the legacy system.*

- *All new systems: In this instance the ITMS being considered would fall in the unique and rare case of both the freeway and the signal application being new implementations. In this case middleware become less obvious with each application essentially becoming instance or client of the integrated system. The manner in which the ITMS is integrated into the remainder of the regional architecture would still need to be examined.*

To further illustrate this stage of ITMS development, the Southern California Showcase project is again examined to review how the deployment planning of the integration technology was accomplished for the integration of multiple legacy systems.

Planning Showcase's Deployment

Conceptually, Showcase is comprised of four independent integration targets (referred to locally as Kernels) and a host of bridges (referred to locally as "Seeds"). The "Kernels" provide a means to independently test the integration of new and legacy systems as well as contain the overall definition of the integrated environment and "lend" services to assist third parties in connecting to the network. The " Seeds" bridge operations to the Corridor. In the current design, one Kernel is placed in each of the following four regions: Los Angeles/Ventura, San Bernardino/Riverside, Orange, and San Diego. These four Kernels partition the Corridor into four manageable domains as shown in the simplified diagram below. The Caltrans wide-area-network (WAN) provides a flexible and scalable network solution for each of the domains. Typically, the majority of information exchange occurs between transportation agencies within their local domain while they receive benefit from their Kernel services. However, when information is needed across domains (shown as example center types in the diagram), the Kernels interact with each other to allow the information transfer. In this manner, information and control can be shared across the complete corridor. In addition to inter-domain communication, the four Kernels form a fail-over network that provides persistent operations in case of Kernel server failure.



"Kernels and Seeds"

Integrating transportation systems onto the Corridor is the primary job of the Showcase Kernel. It is the integration point that provides the catalyst for interoperability and promotion of Showcase interfaces. The Kernel provides several convenient common services to ease the integration effort and defines the interfaces for standardized communications. The Showcase common services are not all resident on the Kernel server; some are distributed, implemented by each agency's center, and some are centralized, implemented by the Kernel only.

3.0 Design Stage

With the successful completion of the scoping and deployment planning stages the groundwork should be in reasonable shape to initiate the actual design phase of the project. To review the first two stages work were intended to:

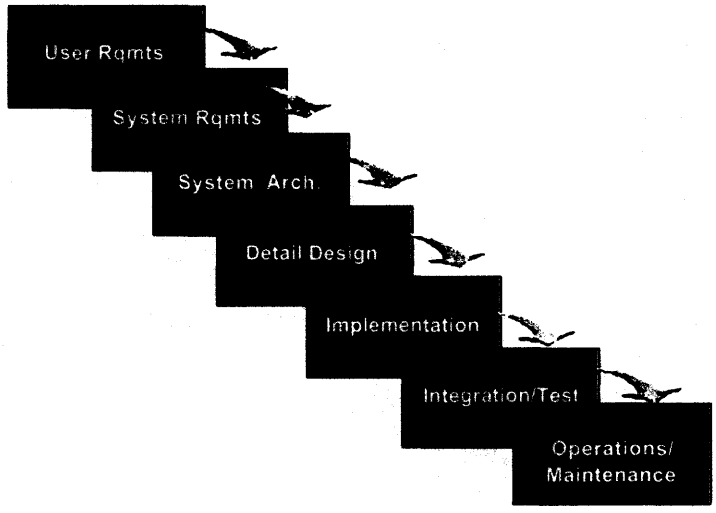
- Determine where in the overall regional ITS deployment picture does the ITMS fit
- The extent (if any) the ITMS will be responsible to define the architecture for the overall ITS deployment picture
- Identifies the extent to which the ITMS technology will be used (if at all) for other integration efforts in the regional setting.
- Establish an operational framework which allows the ITMS stakeholders to understand and be comfortable with their role and responsibility in the operations and maintenance of the ITMS once it is deployed as well as be in control of the extent to which others will have access to their data and control sequences.

- Establish a realistic deployment method which allows ITMS stakeholders to understand how the ITMS will be rolled out, the manner in which the integrity of their day to day operations will be protected and the specific points of interface which they need to continue to pay attention to.

It is suggested that each of the above bullets need to be fully accomplished prior to initiating typical design activities.

The design activities associated with an ITMS should follow best practices associated with any large Systems Engineering activity. There are multiple models available but most fit into one of the following three generic approaches.

3.1 Waterfall Method

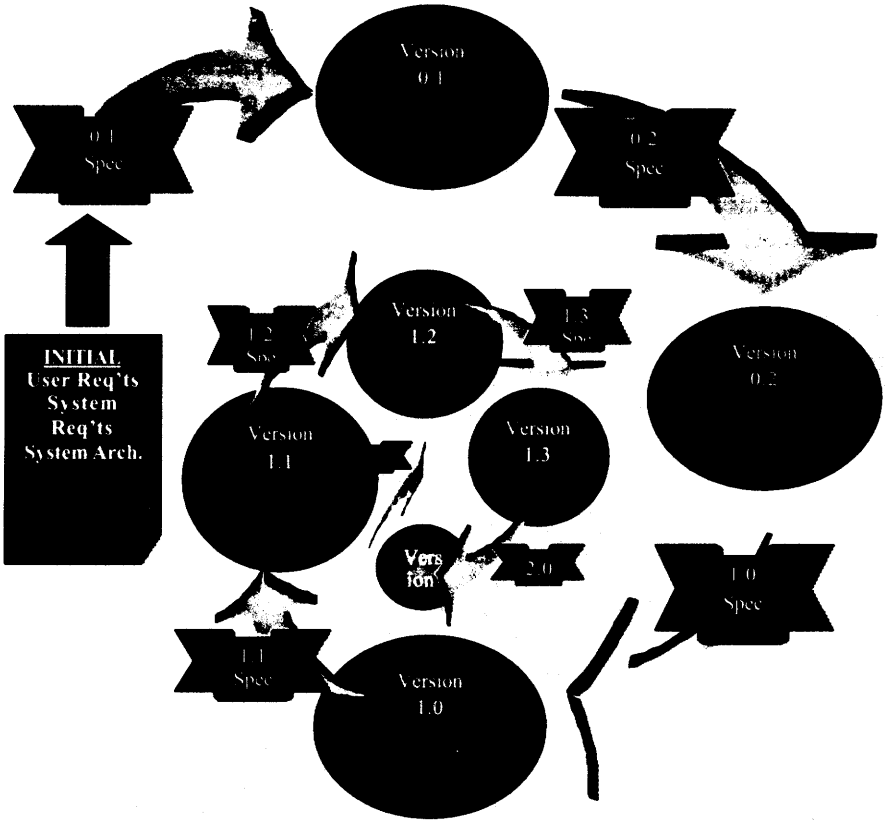


The waterfall method illustrated above makes the premise that the final system implementation is the direct flow-down of user specified requirements. In this method much emphasis is made on the full completion of one step before the next step is initiated. For example no estimation of system requirements would be made until such time that the user requirements are completed and agreed to by the stakeholders. It is also strongly encouraged that a comprehensive requirements tracing method be employed such that for every user requirement defined in the first step there is a complete tracing of that requirement in terms of: the system requirements associated with the user requirements, the manner in which the equipment is accommodated in the architecture, what part of detail design pertains to the requirement, and how/where the requirement is implemented. With this tracing in place the user requirements can if fact be (and should be) used as the acceptance test plan.

The downside of this approach is being able to fully draw closure to the requirements definition stage. Experience shows time and again that not all requirements as necessarily known at the

start of the design exercise and with certainty requirements change as design matures and stakeholders begin to touch and feel the final implementation.

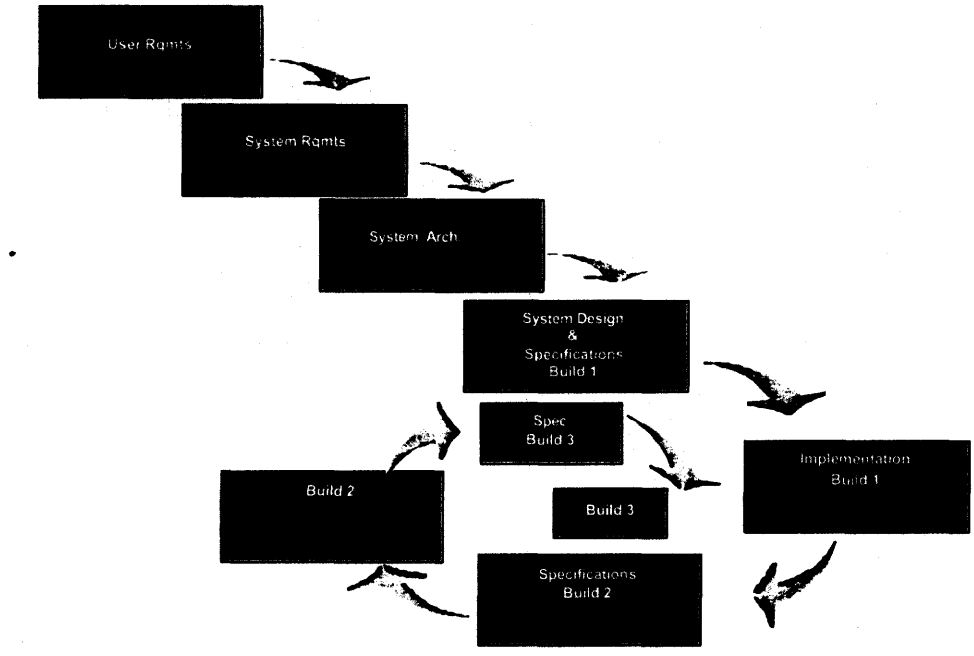
3.2 Spiral Model



The spiral model, used widely throughout industry, depicted above takes as it's premise that requirements and technology are changing constantly so it is preferred to complete just enough of requirements definition and design to enable the preparation of a specification for the first (or next) s/w build or system release. Once that build is implemented and tested and further requirement definition and design is completed and analyses based on the experience of having already built an early version of the system. The advantage to this approach is to check and confirm design premise with actual implementation in a stepwise fashion to ensure that early design decisions are valid and workable for the application in development. The downside of this approach is that some large and particularly difficult user requirement goes undetected for a prolonged period of time and then when finally discovered renders the previous builds of the system unusable.

3.3 Preferred approach for ITMS

The determination of the design model to be used for an ITMS will invariably be tied to where the ITMS fits into the overall ITS deployment picture for a particular region. In the event the ITMS is a one time, stand-alone effort the spiral model likely provides a flexible and efficient means to bring the system on line. In those cases where the ITMS is part of a larger ITS deployment picture a hybrid of the waterfall and spiral approach (as illustrated below) might hold certain advantages. More specifically the strength of the waterfall approach is establish a more complete set of user and system requirements before jumping on board with a particular system architecture. The use of the spiral model would be applied after the determination of the architecture and a series of s/w or system builds would be performed to more rapidly make the integration tool available for the agencies and to provide early opportunities to test and verify that the original architecture and design premise was valid.



In assuming such an approach the following activities would be completed:

- User Requirements: The level of detail to which the user requirements would be defined would be dependent on which system build the requirement was targeted for. For those requirements targeted for the first build (in our example it would be assumed to be the core operational aspects of the ITMS) formal user interviews would be conducted to flush out the specific details of each function. To accomplish this the operational and support staff would be assembled as a single group to define the overall objectives of the user requirement definition phase. The group would then be broken into breakout sessions where a facilitator would flush our requirements using a scenario-based analysis. In each group there would be an appropriate balance of users and designers to ensure that all

requirements were identified and that all requirements were suitably understood by the system designers to effectively bridge the gap that tends to exist between traffic engineers and s/w engineers. For those requirements not targeted for the first installation it is strongly recommended that a small team of users and systems engineers generate a list of user requirements for the entire envisioned enterprise making use of the extensive data and control flow analysis developed for the National Systems Architecture. While such an analysis may not address each and every requirement at the local level it will certainly significantly diminish the concern that some large unforeseen requirement is lurking somewhere beyond the first system build. It will also afford the system designers a glimpse at what is intended for the fully deployed system. This is critical to ensure the correct system architecture is adopted. Once the design process reaches the implementation phase then the spiral model kicks in and the user community gets a chance to define their requirement when their targeted system build is scheduled as the next build. It should also be noted and stressed that the user requirement definition should be sufficiently complete and non-ambiguous so as to form the basis of the system acceptance test.

- System Requirements. The full set of user requirements (those developed as a result of detailed user interviews and those developed as a result of the strategic application of the National Systems Architecture) would be analyzed to determine the logical association of system functions, system performance and storage requirements and operational requirements (downtime tolerances, fail-over requirements, etc). These requirements in conjunction with the application of such standards as the TMDD data dictionary will form the needed input for the next stage of work.

- System Architecture. With a comprehensive set of architectures in place the system designer can begin to design the applicable architecture to satisfy the defined requirements. The architecture, as would be expected, will contain hardware, communications and software components. In terms of the software component several years ago the field was wide open to a variety of architectures to accomplish this mission. However, in the recent past the NTCIP Center to Center working group has made great strides in reducing the number of options to essentially a choice between a CORBA (Common Object Request Broker Architecture) approach and a DATEX based approach. The debate regarding the most preferred approach continues today with advocates from both sides firmly entrenched in their respective position. While the author of this paper has a strong preference for the CORBA approach it is suggested that the reader obtain material from the NTCIP Center to Center working group chair for dissertations on the two methodologies to further explore this matter.

- Detail Design & Specifications. This is the point where the spiral model kicks into the development cycle. Those requirements assigned to the first system build proceed through typical detail design activities. The intent is to develop a comprehensive system specification to completely build the ITMS requirements for the first set of requirements targeted for implementation.

- Implementation. With the specification in place the implementation team builds the system to meet the requirements. At this stage the users need to be concerned with the acceptance test plan for that particular build. It is both reasonable and standard practice to expect that the acceptance test plan directly trace to the user requirements initially defined for that particular build

- Subsequent Design/Implementation. Using the spiral model system build proceed in an incremental fashion until the full set of user requirements are built. It should be noted that use of the spiral model necessitates both designers and users to be cooperative, responsible and accountable throughout the evolutionary refinement of requirements. The safe guard for the users is that the acceptance test for each build should [must] trace directly back to the requirements defined and agreed to for that particular build.

3.4 Important considerations in the design of an ITMS

Regardless of the specific design model chosen, there are number of important design considerations which need to be observed through the course of the development. A summary of these include:

- Performance requirements. An ITMS will have a wide variance of system performance requirements all of which must be fully examined and documented in order that the final design meet the operational need of the implementation. Typical performance requirements include:
  - Device control:
    - Second by second transactions for traffic signals
    - Within seconds for Changeable message signs
    - Within mili-seconds for CCTV control
    - Within seconds for HAR control
  - Data exchange:
    - Within seconds or minutes for data refresh
    - Within seconds or minutes for file retrieval
  - Display requirements
    - Second to minutes screen refreshes
  - Fail-over requirements (if needed)
    - Range from fault tolerant (millisecond) to manual fail-over
  - Technology specific throughputs
    - N objects per second through a s/w service or channel (for example)
  - Deterministic/Non-Deterministic Requirements: In addition to the raw performance numbers it is critical to determine if the requirements is a deterministic or non-deterministic requirement. Deterministic requirements are those that mandate a guaranteed transaction time. An example of such a requirement would be traffic signal co-ordination requiring guaranteed second by second transactions. Non-deterministic requirements are those that would typically require a transaction to occur within a range of specified parameters. For example CCTV control must be responsive within 25 to 50 milliseconds.

- Maintainability: A critical element of an ITMS implementation is the maintainability of the project after it is built. Of equal or greater importance is the implication each time a new system is integrated into the original ITMS environment. The maintenance of the integration environment can and will increase in direct consideration of the integration technology used. This range is extremely wide ranging from a manageable linear type of growth to a staggering form of exponential growth for each new system added to the network. Therefore, early identification of specifically how the ITMS fits into the overall regional ITS vision is absolutely critical before an ITMS integration technology is adopted. In the case where the ITMS is part of a larger ITS vision maintainability must be a prime feature of the design exercise. To accomplish this feature common services need to be identified and built which all systems integrating to the network will make primary use of. To illustrate the California Showcase is again uses as an example.

  Designing Showcase for Operations and Maintenance

  Showcase adopted a philosophy of design once deploy many tines to form an economy in that each new system to be added to the network need only design to the common service of the integrated environment instead of the unique and peculiar nuances of each and every other system on the network. Overall system operations is enhanced in that there is no need to recompile the entire showcase network each time a new system is added rather, the new system needs only to register with the corridor system. Additionally, a potentially huge detractor to establishing the showcase network had been the specter of a massive maintenance effort in attempting to first bring disparate systems into alignment and then, to an even greater degree, keep the systems in alignment over time. The key to shrinking this specter down to size in the ability to abstract the uniqueness of each of the individual systems and wrapping them with common corridor architecture definition. This is largely achieved through the use of the Showcase common services. The common services built for Showcase include the following:

  - *Kernel management service is the portal to information located in Showcase. Agencies must first log into the Kernel through this service to gain access to the Corridor resources. Once a valid login is complete, the agency can utilize other Kernel services, such as, Publish / subscribe, Query, Naming, and Trading. If a Kernel server fails, the remaining Kernels can provide the login for any domain.*
  - *Publish / subscribe is a Kernel centralized service that allows agencies on the Corridor to publish transportation information at and across domains. Agencies can also subscribe and receive published data from anywhere on the Corridor. If a Kernel server fails, the remaining Kernels provide this service.*
  - *Query is a Kernel centralized service that allows an agency to search and receive information from multiple sources using a single query. Data is returned as results in a table view; for example, a query for cameras in the City of Los Angeles would return a table listing of all freeway and arterial cameras in Los Angeles.*
  - *Naming / Trading service is the primary method for locating resources on the Corridor network. Given a resource name or a resource advertisement from the Naming or trading service, respectively, an agency can find and connect to that resource.*

- *Security is a distributed service that controls access to Corridor resources. Each agency that implements security uses this service to protect and limit access to their center's information and device control.*
- *Location translate is a centralized service that translates between various geographical coordinate systems. For example, an agency could translate a device's latitude/longitude to state plane coordinates for display purposes.*
- *Video management is a distributed service that is implemented by each agency that wants to allow access to its video resource.*
- *Device locking is a distributed service that is implemented by each agency that wants to lock device access and control to a single user of highest priority.*

The application of NTCIP's C2C standards development is part of Showcase's device interface definitions. Using the Common Object Request Broker Architecture (CORBA), as defined by C2C Working Group, the device interfaces have been designed and implemented as CORBA objects using object-oriented techniques (e.g. inheritance and encapsulation). The first version of Showcase objects includes the following: CCTV, Video Switch, Congestion, Event, Bus, and Route. Deployment of Showcase objects and widespread use of CORBA technology has resulted in consistent and interoperable communications throughout the Corridor. Interface definitions coded in CORBA Interface Definition Language (IDL) control the versioning and changes to these objects so that interoperability can be maintained while the Corridor continues to evolve new functionality.

In the roll out of Showcase, four Kernels are deployed to the four regions of the Southern California ITS Priority Corridor to begin interoperating with the early start projects and providing the needed services for new development. Successful deployment of two early start projects, TravelTIP and IMAJINE, will soon validate that the Showcase foundation provides a high degree of flexibility and functionality between transportation centers. As more early starts roll out, and new development with creative ideas flow into the Corridor, there is a high degree of confidence and anticipation that Showcase will prove to be the enabler we all hoped for in the Southern California deployment of ITS.

4.0 Information Technology (IT) Considerations

In the past, the development of traffic management systems have had the option of using their departments IT standards or to choose to co-exist with the IT activities because of the differences between control systems and then typical business applications and their associated technologies. However there is a broad movement across the U.S. for control agencies, particular at State levels, to bring all technology deployments under the umbrella of IT . As such, the luxury of simply co-existing with IT departments is rapidly coming to an end

The role of the Information Technology (IT) department has changed significantly over the last 20 years. In the early days, the typical IT department maintained the corporate mainframe and assisted users with terminal access and corporate software. Large agencies and/or companies tended to develop and maintain proprietary software that was specific to the operations of the

company itself. Over time, many IT paradigms have come and gone that have served to shape the structure of today's IT department. Elements such as computer downsizing, client-server applications, object-oriented development and platform independence have all contributed significantly to the overall shape of the IT industry.

Today, IT departments are faced with the daunting accountability of being responsible for a wide variety of complex systems that comprise an enterprise wide computing solution. The personnel resources necessary to properly support the enterprise network include a variety of experts from different technological areas. There are now user level computers with potentially different operating systems and applications, departmental level servers for the database, web site, accounting system, and many other specialized applications. Add to this, the modern networking capabilities and the varying technologies utilized for data transmission, as well as the platform independent, object oriented, modular software techniques and the speed at which technology changes, and it quickly becomes obvious that today's IT department faces many challenges.

The complexity of agencies' enterprise wide technology investments became significantly more visible to Federal, State and Municipal control agencies with the sudden attention prompted with the passing of the millennium. Extensive surveys and analysis was completed in anticipation of Y2K date computation anomalies. In some instances new control agencies were formed by gubernatorial mandate to provide a central monitoring and approval mechanism for any project that was in the least manner associated with a database, computer or network. While Y2K came and went with considerably less issues than what had been heralded, the perception in the minds of many legislators regarding the state of affairs in State owned technology continued towards the need for central control. The natural vehicle for the implementation of these new controls has been the I.T. groups within the operating agencies. The issue for ITMS is simply that traffic control systems have normally grown from the efforts from the operational side of D.O.T's. In many instances the systems engineering approach and vernacular used by the operations group and that used by the more product oriented I.T. groups coupled with basic turf issues has unfortunately served to slow and in certain instances derail ITMS efforts underway across the nation.

The need, then, is to determine <u>early</u> the authority the applicable I.T. group has on a project and to chart a course of progress that serves to reconcile fundamental differences in the approaches used by Operations Groups and IT groups. It is suggested that the days of avoiding I.T. involvement in ITS undertakings has been effectively terminated by legislative concern over the results of technology assessments conducted as part of Y2K activities. Projects that avoid I.T. authority today tend to run into significant difficulties when attempting to procure the desired platforms for their programs tomorrow. The solution to the dilemma lies in the ability of the ITMS project team to sit with I.T. personnel throughout the entire design process such that when the recommendations for specific ITMS technological components are brought forward the I.T. personnel are fully versed with the needs associated with the near-real time requirements of ITS and have been made aware through deliberate efforts of the ITMS project team of the limitations which their standard I.T. components in meeting those near-real time requirements.

Managing and Operating Integrated Transportation Management Systems: Policies, Procedures, Funding and Staffing Issues[1]

By
Walter H. Kraft, D. Eng. Sc., P.E.[2]

Introduction

Management and Operations (M&O) are not new concepts in our daily lives, although they have not been prominent in the roadway transportation environment, where we have concentrated on providing infrastructure for the past 50 years. M&O has been prominent in the railroad, mass transit, airline and waterway transportation businesses for many years and these businesses could not function without M&O. It is unfortunate that roadways were constructed and not managed and operated with the same level of commitment as the other transportation businesses. I have purposely called these businesses even though many are the responsibility of government. Why shouldn't travelers receive value for the value they have given to use a transportation mode? The value they give could be in the form of taxes, a fare, a fee or an assessment. The value they receive should be safe, reliable, and efficient transportation. This is an important reason why Integrated Transportation Management Systems (ITMS) should be a significant component of any region's transportation system.

It would be useful for you to understand M&O as I do since I will be referring to it many times. My definition of *management is the allocation of resources necessary for the proper functioning of the system where the system could be the regional transportation system or an individual modal system. Operations are all actions necessary for the proper functioning of the system(s).* Operations are more that those usually associated with Intelligent Transportation Systems (ITS). ITS is a tool that supports operations.

Management and operations of our transportation systems becomes more important as families attempt to gain more affordable housing by moving further away from city centers. They seem to be willing to accept higher transportation costs as a trade-off for more affordable housing. A recent study by the Surface Transportation Policy Project reported that the average household in six metropolitan areas spends more on transportation than housing. Below is summary of the their results.

	Spending ($)		
City	Transportation	Shelter	Percent
Houston	$9,237	$7,167	29
Phoenix	7,851	7,725	2
Kansas City	7,558	6,538	16
Dallas/Ft Worth	7,524	7,358	2
St. Louis	6,790	6,435	6
Pittsburgh	5,623	4,945	14

[1] For presentation at the Integrated Transportation Management Systems Conference on July 17, 2001 in Newark, New Jersey

[2] Senior Vice President, PB Farradyne Inc.

This presentation will discuss issues dealing with four basic elements that are important for the management and operations of ITMS – Policies, Procedures, Funding, and Staffing

Policies

Policies are necessary to provide a framework for the public to express its will through the actions of elected officials. There are many policy issues that could be discussed, however this paper will concentrate on two of them – Partnerships and Standards – that are basic to managing and operating Integrated Transportation Management Systems.

Partnerships – How can agencies be encouraged to consider all forms of partnerships to share or acquire infrastructure and other resource requirements? Sometimes agencies will consider public/public partnerships, but they are often reluctant to consider public/private partnerships because of the different goals of each organization. A public/partnership offers many advantages and combines the goals of public well being with a financial motive. In many cases legislation needs to be changed to permit this type of partnership.

Standards – Standards are available for almost all design aspects of transportation infrastructure. While these standards have provided guidance for many years, new standards are needed for the new components and systems. Furthermore, standards need to be protected and modified to reflect changing technology and conditions. The current development of ITS standards represents a substantial investment in time and effort by many agencies and individuals. An example of how standards need to be protected is remembering what happened to the NEMA controller standard. After the standard was developed, some manufacturers developed enhanced NEMA controllers, which did not meet the NEMA standard. A similar situation could occur with the new Advanced Traffic Controller or other ITS standards if there is no group to maintain the standard. Likewise there must be a group to modify the standards due to technological or other changing conditions. Who should be responsible for maintaining standards? What should the federal role be with respect to standards? How often should standards be updated? Is there a way to shorten the time to develop standards? Should national standards be mandated for all projects? Who should make the decision with respect to mandating standards for all projects?

Procedures

Procedures are the interpretation of policy by those responsible for carrying out policy. In most cases, procedures provide a reasonable interpretation of policy; in some they have been changed to provide a better interpretation or to reflect changing conditions. The following discussion starts with some of the procedures that are more general and concludes with some of the procedures for specific actions.

Inter-jurisdictional Committees – Inter-jurisdictional jealousies have often thwarted the integration of transportation systems to the detriment of the traveling public. One way of overcoming these jealousies is to form inter-jurisdictional committees. These groups can develop strategies and plans to address situations that affect regional travel, including significant incidents, weather, special events, and construction and maintenance activities. How can inter-jurisdictional committees or teams be established to coordinate activities and develop management strategies and operational plans? What is the appropriate level to staff

multidisciplinary and multi-jurisdictional groups to assure commitment from the participating agencies?

Inter-Agency Agreements – Coordination and cooperation among agencies are frequently documented in interagency agreements, either orally or verbally. A major impediment can be getting each agency to approve an agreement. One approach is to keep the agreement at the lowest possible level and to keep it informal. Another approach is to have the agreements signed at the highest levels. There are advantages and disadvantages to each approach. With the first approach, high-level support may be denied when it is needed. With the second approach, the legal reviews may take a considerable amount of time and may never be concluded. What agreements are necessary and how detailed should they be?

The development of agreements should be started well in advance of when the agreements are needed. During the development of the New York City Early Deployment Plan, a number of committees were formed. One of these was on operations and maintenance. After more than 10 meetings the group developed a Checklist for Memorandum of Understanding as outlined below:

CHECKLIST FOR MEMORANDUM OF UNDERSTANDING
(Project Title)

I. Purpose of Project
II. Definition of Terms
III. Roles/Responsibilities of Each Agency
- In Program
- In System(s)
- In Operational Plan
- Information Dissemination
- Cost Sharing/Financial Obligations

IV. Liabilities/Indemnification
V. Restrictions/Constraints
VI. Expansion of Program
VII. Renewal/Amendment/Modification of MOU
VIII. Dissolution of Program
ATTACHMENT 1. Description of Project
- The System(s) Plan
- The Operational Plan

ATTACHMENT 2. Program Management
ATTACHMENT 3. Compatibility/Expandability of Systems

The Checklist was developed in anticipation of the agreements that would be needed to implement the Early Deployment Plan. An important strategy used for these meeting was to consider all agencies to be equal and not have one of them be in charge of the meeting. The meetings were arranged, facilitated and documented by non-agency resources. This strategy reduced the risk of any agency forcing their agenda on the other agencies just because that agency was responsible for the meeting. Are there other checklist items that should be added,

deleted or changed? Do all agreements have to be written? If agreements are not written, how will the procedures have permanence?

Some regions have agreements executed at the lowest possible level as long as they do not involve the issues of liability, policy or funding. What system will work in your region? Is a legal review always necessary? If a legal review is needed are instruction given, such as, "How can we make this agreement possible?"

Operating Procedures– Operating manuals document the procedures used by an agency to deal with the operations of their transportation system. Recently, the Management and Operations Committee of the ITS Council of ITE developed an *Annotated Outline for a Traffic Management Center Operations Manual.* It can serve as a checklist for an agency's manual and includes the following sections:

1. Emergency and Other Contact Numbers
2. Daily Operation
   - 2.1. Management Center Functions
   - 2.2. Personnel
   - 2.3. Hours of Operation
   - 2.4. Staffing
   - 2.5. After Hours On-Call Roster
   - 2.6. Remote Operation
   - 2.7. Security Procedures
   - 2.8. Maintenance Checklist
   - 2.9. Startup/Shutdown
   - 2.10 Failure Recovery
   - 2.11 Agency/Jurisdictional Contacts
   - 2.12 Notification Procedures
   - 2.13 Contact With Media
3. Control System Operation Procedures
   - 3.1 Operator Interface
   - 3.2 Operational Procedures
   - 3.3 Incident Management
4. Maintenance Procedures
   - 4.1 Routine Maintenance
   - 4.2 Preventive Maintenance
   - 4.3 Spare/Backup Equipment
   - 4.4 Emergency
   - 4.5 Contract Maintenance
5. System Operations Logs
   - 5.1 Operations
   - 5.2 Maintenance
   - 5.3 Events
   - 5.4 Systems Reports
   - 5.5 Traffic Data
   - 5.6 Risk Management
6. Operational Concepts
   - 6.1 Traffic Control Concept Strategy
   - 6.2 Traffic Monitoring
   - 6.3 Data Analysis And Warehousing
   - 6.4 Interagency Coordination
   - 6.5 Inter-jurisdictional Coordination
   - 6.6 Emergency Procedures
7. Control Center Description/System Field Devices
   - 7.1 Location
   - 7.2 Access/Security
   - 7.3 Layout
   - 7.4 Fire Suppression
   - 7.5 Power Source/Location
   - 7.6 HV/AC
   - 7.7 Data Communications
   - 7.8 Voice Communications
   - 7.9 Network Communications
   - 7.10 Field Device Descriptions
8. System Documentation

Should all agencies in a region have such a manual? Should there be a common format for these manuals? How should manuals be treated in an integrated system? Should sections of the manual be added, deleted or changed from the above list?

Publicize the Benefits – Nothing breeds success like success. The public is not aware of the benefits that can be attained from managing and operating integrated systems. We need to share the good news with them. As a profession we do not aggressively promote the benefits of traffic management. Even information on individual systems is frequently distributed solely within the profession. The December 22, 2000 issue of The Urban Transportation Monitor reported that the Plano, Texas saved $7.5 million in user costs by optimizing about 80 signalized intersections. Benefits realized were:

- 509,340 gallons per year reduction in fuel consumption,
- 16,956,420 fewer stops per year,
- 432,120 reduction in hours of delay per year, and
- $7,466,179 reduction in yearly operating costs.

While this information may help other professionals in their work, it also needs to be given to decision makers at the national, state, and local levels, as well as the traveling public.

The operators of the San Antonio Freeway Management System observed about a 40% reduction in the clearance times of major incidents by improved organization of the response and clearance efforts for freeway incidents.

Both of these examples provided significant benefits to the traveling public, which should be shared with an audience larger than our fellow professionals. The media needs to know of these benefits. An added benefit is that the professional community will tend to do more since they know that their efforts are making a difference.

The Minnesota Legislature mandated that the ramp metering system in the Twin Cities metropolitan areas be shut down for a period of time to determine the effectiveness of this system. The traffic flow and safety impacts associated with turning off all 430 ramp meters were evaluated during the six-week turn off period. The study results indicated:

- 9 percent reduction in freeway volume,
- 22 percent increase freeway travel time,
- 7 percent reduction in freeway speeds,
- 91 percent decrease in freeway travel time reliability, and
- 26 percent increase in crashes without ramp metering.

The turn off of the Twin Cities ramp meter system caused increased congestion, decreased safety, and inconvenience to the traveling public. How can such experiments be avoided in the future? What are effective ways of informing the media and the public of the benefits of managing and operating integrated transportation systems? Is there a database of these benefits? How can professional organizations help distribute this information?

Closing Ramps – Closing ramps is one strategy to alleviate congestion on freeways. Initially this strategy was used for isolated ramps. Recently a proposal has been made to close seven interchanges along a freeway during the a.m. and p.m. peak periods. Is this a reasonable operating strategy? What procedures must be in place to coordinate travel on both the arterial and freeway networks? What characteristics and tradeoffs should be considered to determine the times of closure? What information should be provided to the public and at what times? What physical infrastructure should be used for the closure?

Quick Clearance – Incidents have gotten more attention as we realize that quick clearance has many benefits including reducing congestion, secondary accidents and injury to response personnel. There are conflicts between quick clearance, meeting the requirements of crash reconstruction and removal of hazardous materials. Is one more important than the other? Can actions be taken to gather minimum information during peak periods and then get more detailed information during off-peak periods? Are there a minimum number of lanes that should remain open at a crash site? Should aerial photos be taken of all crash sites? Will changes to tow vehicle procedures help?

Pre-Trip Information – Travelers have the opportunity to check the Internet for real-time traveler information before they set out on a commute or local trip in many areas. How effective is this information in helping travelers schedule their trip? Will travelers divert to a bypass route or are they concerned that they will get lost and encounter worse conditions? Will they prefer to stay on the freeway? If travelers tend not to divert, what actions will be necessary to continually optimize the performance of the system?

Methods for Freeways and Arterials Are Not Necessarily the Same – Traffic flow characteristics are not necessarily the same for freeways and arterials and therefore managing and operating methods may be different. For example, traffic cone placement on freeways is different than arterials because of different vehicle speeds. What other different methods need to be identified. How can these be defined? How should this information be distributed?

Funding

Funding has and will continue to be an issue for the management and operations of Integrated Transportation Management Systems. For many years agency budgets were directed toward providing infrastructure with agencies being organized for that purpose. As we realize that roadways needs to be managed and operated, agencies need to fulfill the role of managing and operating the infrastructure that they provide by rethinking their respective roles and organization. New responsibilities require new thinking. A few selected funding issues are discussed below.

Use of Funds– Most agencies in the United States develop separate budgets for capital and maintenance costs while in many other parts of the world, agencies are given a budget for providing transportation without separate designation for capital, operating and maintenance expenditures. Is there a better way to fund transportation that designating separate budgets? Should there be restrictions on how local and state government use federal funds for transportation? What restrictions are reasonable? How can the funding decisions for capital,

operating and maintenance expenditures be combined into a single process instead of being done separately?

Management and Operations Costs – There is little information on the actual costs to manage and operate individual systems as well as integrated systems. In many cases these costs are divided among various budgets. The net result is that the management and operations costs for many new systems are being conceived using rules of thumb to allocate funds. One state DOT uses dollars per centerline mile of system roadways. Others use a percent of construction costs or present worth. Is there a best method of calculating these costs? How can this information be shared to develop a database of costs? Can reasonable estimates be made of these costs with the traditional low-bid method of procurement since the type or quality of equipment cannot always be predicted? What other methods of procurement are better?

Legislation vs. Regulation – Some have expressed concern that laws may be flexible, while the resulting regulations are not flexible. Those writing the regulations want to provide accountability and consistency. TEA 21 increased the eligibility of operations improvements for all types of Federal-aid. However, procedures and regulations make it difficult to use these funds for operations purposes. How can the goals of both flexibility and regulation be accommodated? What changes need to be made to the process of approving regulations? How can the procedure and regulation processes be changed to provide an incentive to use the funds more effectively?

GASB 34 - Next fiscal year, the value of public infrastructure of state and local governments will have to be reported in their yearly financial statements. In 1999, the Governmental Accounting Standards Board (GASB) approved *Statement No. 34: Basic Financial Statements – and Management's Discussion and Analysis –for State and Local Governments.* Generally accepted accounting principles for local and state governments are defined by this non-profit organization. The accounting methods described in Statement No. 34 will put more pressure on agencies to preserve their infrastructure and provide more funding for operations and maintenance. Currently, state agencies spend a larger portion of their budgets on capital projects, while the opposite is true for local governments. Which level of government should be responsible for maintenance? How will agencies need to account for infrastructure in their yearly financial statements? Will GASB 34 improve the imbalance of funding? Are there ways that agencies can work together to provide a better balance between short-term fixes and long-term solutions? How can agencies be educated about the benefits of preserving their infrastructure?

Life-Cycle Costs – Life-cycle costing of projects has often been portrayed as a way to reduce the long-term costs of projects. As an example, agencies have experimented with using more expensive pavement construction methods and materials to increase the useable life of a roadway. Such approach has higher capital costs and lower recurring maintenance costs, resulting in a lower infrastructure cost over the life of the facility. Since many governmental agencies budget fewer years than the life of most facilities, how can government be educated on the benefits of life-cycle costing? Who should take the lead? Should this method be made mandatory for all projects?

System Replacement – The useful lives of the components of an integrated transportation management system are not the same and are much different that those for typical infrastructure projects. Funding must be allocated for replacement when the useful life of the component is almost over. The useful life of computers and software is three to five years. The components of a communications system are continually being improved, resulting in increased obsolescence. How can these concerns be accounted for in current programs? What changes are needed to current programs? What information needs to be given to decision makers to have them realize that the funding stream is not even?

Staffing

In the past, governmental employees generally provided governmental services. A trend has evolved to reduce the size of government and outsource many services, which has brought new challenges related to staffing for the management and operations of Intelligent Transportation Management Systems. Some of these issues are discussed below.

Hiring and Retaining Staff – It is often difficult for public agencies to recruit and then retain personnel that possess the skills necessary to operate and maintain the sophisticated hardware associated with ITMS. Proper operations and maintenance can require salary schedules higher than typical maintenance or electrician rates and agencies are often unable to pay these salaries. What factors encourage personnel to join and stay with public agencies? How can these factors be enhanced? Which levels within government are most vulnerable to outside recruiting? What can be done to retain these employees?

Public vs. Private Staffing – Some agencies have decided to use outside contractors either on a full or part time basis to satisfy or supplement their staffing needs. Outside contractors have been used successfully for the maintenance of many traffic signal systems in this country for many years. More recently outside contractors have been used to manage and operate Transportation Management Centers (TMC's), such as the INFORM system in New York, the I-95 Incident Management System in Connecticut, the freeway management system in Detroit, Michigan and the TRAV-Info system in San Francisco, California. Outside contractors are also frequently used during the initial start-up of a system as was done for a six month period with the I-4 system in Orlando, Florida.

How should a decision be made to use public sector in-house staff instead of private sector outsourced staff? What contracting methods are appropriate? Is one better than the rest?

Cross Training – In the past, control centers were staffed by one agency. As systems become more integrated, personnel from many agencies may be in the same control center. Cross training can help during agency shortages and will provide an appreciation of the other person's responsibilities. Should personnel in a joint control center be shared? How can cross training be accomplished? How can agency job descriptions be changes to provide for joint operations?

Conclusions

This paper has focused on four issue areas – Policy, Procedures, Funding and Staffing. Policy issues deal with the creation of partnerships to enhance transportation and the maintenance of standards to further the integration of individual systems.

Procedure issues dealt with:

- Inter-jurisdictional Committees
- Inter-agency agreements
- Operating Manuals
- Closing Ramps
- Quick Clearance
- Pre-trip Information
- Methods for Freeways and Arterials Are Not Necessarily the Same
- Publicize the Benefits

The procedure issues focused on the way agencies can work together, some operating strategies, and ways that national, state and local decision makers as well as the traveling public could be made aware of the benefits of integrated transportation systems management.

Funding issues dealt with:

- Use of Funds
- Management and Operations Costs
- Legislation vs. Regulation
- GASB 34
- Life-Cycle Costs
- System Replacement

Funding issues centered on raising issues with the allocation and use of funds, the need to simplify processes, the need for better estimates of management and operations costs, and the need to consider replacing components of the system before they become obsolete or non-functional.

Staffing issues dealt with hiring and retaining staff, public vs. private staffing and cross training. These discussions have just scratched the surface.

There are many issues dealing with the management and operations of integrated transportation systems. These need to solved as the focus on integrating systems become more intense. In the future agencies will need to work closer together and coordinate the management and operations of their individual transportation systems with those of other agencies in their systems.

References

1. Meyer, Michael D., *A Toolbox for Alleviating Traffic Congestion and Enhancing Mobility*, Institute of Transportation Engineers, 1998.
2. Giblin, James M. and Kraft, Walter H., *Traffic Control System Operations – Installation, Management and Maintenance*, Institute of Transportation Engineers, 2000.
3. *Management and Operations of Intelligent Transportation Systems – A Recommended Practice of the Institute of Transportation Engineers*, Institute of Transportation Engineers, September 1999.
4. *Traffic Control Systems Handbook, Report No. FHWA-SA-95-032*, Federal Highway Administration, February 1, 1996.
5. Briggs, Valerie, *Operations in a Regional Transportation Organization Environment*, ITE Journal, January 2001
6. Dornan, Daniel, *Accounting Rule Fixes Roads,* Engineering News Record, April 9, 2001, pg. 55.
7. *ConnDOT Proposes Closing Entrance Ramps to Reduce Congestion*, THE URBAN TRANSPORTATION MONITOR, February 2, 2001, pgs 1 and 3.
8. *Transportation Operations Dialogue* at http://www.nawgits.com/opdialog/index.cgi
9. *An annotated Outline for a Traffic Management Center Operations Manual, October 2000.* Prepared by the management and Operations Committee of the ITS Council of the Institute of Transportation Engineers
10. *Spending more on the road than at Home*, USA TODAY, March 5, 2001, pg 4A.
11. *Benefits of Improved Signal Timing Quantified in Plano, TX*, THE URBAN TRANSPORTATION MONITOR, December 22, 2000, pg. 7.
12. *Newsletter of the ITS Cooperative Deployment Network (Email Version)*, various issues from January to March 2001.

TRAFFIC MANAGEMENT STRATEGIES

AND

OPERATIONAL PLANS

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City of Toronto

May 4, 2001

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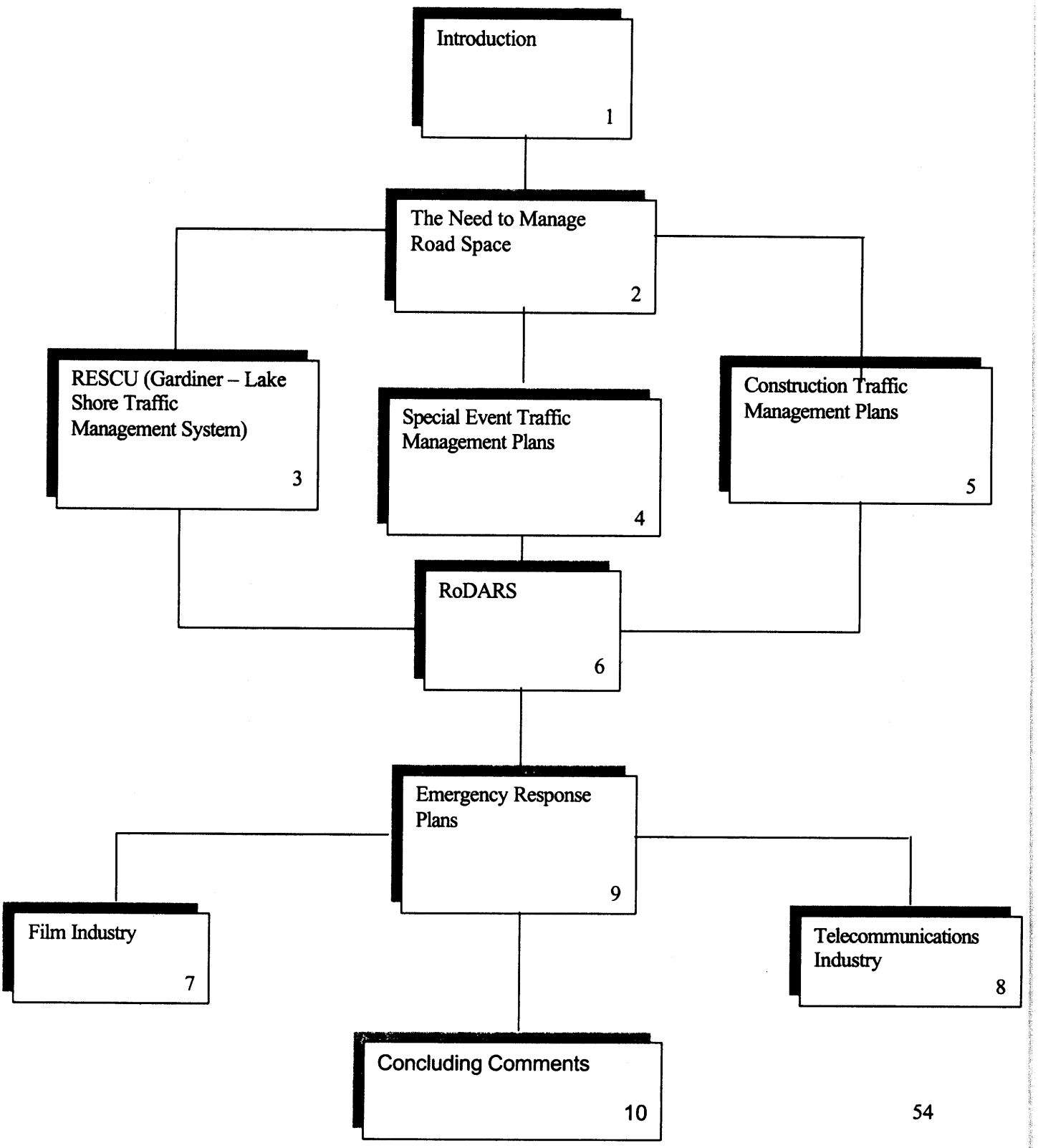

Chapter 1 – Introduction

Reason for Winter Delays? Those Pesky Fibre Optics

"Winter is supposed to be hibernation time for road construction crews, isn't it? Not this year. Across Toronto, motorists are still encountering unexpected delays, often due to underground work such as fibre-optic installation and the repair of water mains. I think Adelaide Street must be the worst – especially late at night. I have seen traffic on this four-lane artery bottled into one lane, with orange safety cones planted everywhere.

Down on the east waterfront, the Gardiner demolition project has found a steady rhythm, now that concerns about lead-laced dust have been addressed. One new off-ramp is open, but if you are on Lake Shore Boulevard East, you can count on being shunted down to Commissioners Street right through until fall. On Eglinton Avenue East near the Don Valley, that delay-plagued bridge project is still causing hassles. The road is fully open, but expect rough pavement until it can be resurfaced in late April.

You can also expect grief along Mount Pleasant Road from Merton Street to Eglinton, where curb lanes may be closed from 7 a.m. to 4 p.m., once again due to fibre-optic street surgery. Heading along Eglinton, in the old city of York, the eastbound curb lane is blocked daily between Dufferin and Bathurst. Oh my, this one is for a "multi-media fibre network." Crews are supposed to clear out during rush hour, but even at the best of times, that part of Eglinton spends most of the day and night clogged.

> **Listen to "Roady"** If you are the kind of driver who needs to stay away from construction delays, you may want to keep a phone number in your head. Call (416) 599-9090 for all sorts of restrictions along routes belonging to the province and the City of Toronto. The various recordings about roadwork are hosted by the imaginary character Roady Knowall, who, when unmasked, is known as Bruce Cadenhead. This winter, he says, "we're busier than we usually are" due in part to those exciting fibre optics and dull water mains.

I unashamedly endorse this service when used in conjunction with radio traffic reports, especially for drivers who have to cover long distances. Unfortunately, the 905 region is not served by this central info line; an inconvenience suburban drivers will have to take up with their local politicians."

Article in the Canadian National Post (Friday February 2, 2001)

Chapter 2 – The Need to Manage Road Space

The availability of road space in urban areas is at best a static asset. However, the reality in most large urban areas is that road space is, in fact, a diminishing commodity. This is not to infer that our roads are physically shrinking, but certainly the demands on road space are increasing for both traditional use (moving vehicles) as well as non-traditional use (special events, parades, filming, etc.).

The laws of economics indicate that as an asset becomes more scarce, its value in the marketplace increases. In times of scarcity, the need to manage an asset to ensure optimum productivity becomes more crucial.

Over the past 25 years, much progress has been made in striving for 100 percent optimized utilization of our freeway system, starting with minor geometric improvements. More recently the focus has been on new advancements in technique development (e.g. incident detection algorithms), technology evolution (e.g. sensors, cameras) and integrated system applications (e.g. Traffic Management Centres). These are discussed in Chapter 3.

One of the major challenges facing our industry is to transport all of the lessons learned on our freeway system and apply them to our urban arterials to mitigate the disruptions caused by special events (Chapter 4) and construction activities (Chapter 5).

A tool for prioritizing and coordinating schedules for these activities is addressed in Chapter 6.

The additional pressures on our road system from the film industry and the telecommunications industry are discussed in Chapters 7 and 8 respectively. The need to have operational plans ready for non-transportation emergencies is addressed in Chapter 9. Chapter 10 contains concluding remarks as well as outlines some new initiatives, to help manage our road system.

Chapter 3 – RESCU (Gardiner – Lake Shore Corridor Traffic Management System)

In 1979, Donald Capelle's introduction to the Transportation Research Board publication "Freeway Traffic Management" included the following paragraphs:

"The growing need for better management of freeways to provide increased levels of capacity, service, and safety is becoming more and more apparent. Experience has shown that freeway management systems can significantly improve the movement of people by:

- Detecting and responding to accidents, disabled vehicles and other incidents that affect the flow of traffic.
- Restraining traffic flow at certain points to prevent congestion at more crucial points, which helps traffic move through critical bottlenecks.
- Giving priority treatment to higher-occupancy vehicles (such as buses and carpools), which increases the person-moving capacity of the freeway.
- Diverting traffic from congested sections of a freeway to under-used roadways serving the same corridor.
- Providing real-time information to the motorists, aiding them in efficient utilization of the freeway system.

Programs to improve the capacity and efficiency of urban freeways are not new. As early as 1955, the City of Detroit implemented a project on the John Lodge Expressway that used closed-circuit television for freeway surveillance. Chicago, Detroit, Houston, Los Angeles, and Dallas pioneered the application of freeway surveillance and control in the early 1960s. New York applied the technology to increase the flow of traffic through the Hudson River tunnels. Based

on the success and experience of these early experiments, freeway surveillance and control systems are now being developed and placed in operation in a number of urban areas throughout the world.

Initially, projects focused primarily on the hardware aspects of surveillance and control, but experience soon showed that other elements were equally important: development of good relations with the public, the press, and concerned political jurisdictions; participation of police, fire, and maintenance organizations; development of operating procedures and control logic; and staff considerations."

The City of Toronto was one of the "followers" to all of these pioneering efforts when it embarked on the RESCU project (Road Emergency Services Communications Unit) in the late 1980's with operation commencing in 1994. RESCU operates in the Gardiner-Lake Shore Corridor, which includes an urban freeway (the F.G. Gardiner Expressway) and a parallel signalized arterial (Lake Shore Boulevard), both of which form a major access route into downtown Toronto.

RESCU monitors and manages traffic flow along the Gardiner Expressway and along Lake Shore Boulevard. RESCU makes extensive use of traffic monitoring equipment and motorist information devices to improve traffic flow within the corridor.
Co-located at the Traffic Management Centre, the Traffic Signals System controls and monitors approximately 1,900 traffic signals throughout the Toronto area. In addition to standard time-of-day signal timing plans, enhanced signal operation has been introduced with SCOOT traffic adaptive control operating at 250 intersections.

The Traffic Management Centre also includes a Traffic Situation Room (TSR), which serves as a clearing house for traffic information throughout Toronto, consolidating incoming information, relaying it to the appropriate Transportation staff for response, and disseminating it in a standardized format to external agencies. The role of the TSR includes the development of traffic strategies for both planned events (e.g. construction, special events) and unplanned events (e.g. major incidents, emergency situations). The TSR relies on close communication and co-ordination with other emergency/transportation agencies. The overall traffic management capability is demonstrated in the following example:

"The time is 8:05:43 a.m. The traffic staff are monitoring traffic flows in accordance with established routines. Suddenly, an audible "beeping" alerts staff in the control room that a traffic incident has occurred. An operator consults her CCTV monitor, and zooms in on the location of the incident to discover that an overturned transport truck is blocking a freeway entrance ramp as well as two out of three lanes of the freeway. This has occurred at the height of rush hour.

The operator moves quickly into action, approving the diversionary response plan automatically suggested by the system, invoking instant responses from changeable message signs. The traffic signal system automatically introduces timing adjustments on adjacent arterials. She presses a button and speaks to a nearby police officer who, after inspecting the accident on his own CCTV monitor, dispatches to the scene a fleet of emergency vehicles and heavy duty vehicle movers. The operator then turns to the person monitoring the signalized arterial traffic, and watches her colleague monitor the response plan for the arterials affected by the incident. Another operator,

following the action from a few feet away, has received the incident data on her networked terminal, and is already dispatching automated emergency bulletins to the media and transportation agencies. Full response measures have been deployed within 100 seconds of detection!

In this short time a number of agencies have sprung into action armed with accurate information on what awaits them at the scene of the incident. They reach the overturned truck fully prepared and equipped to respond to the incident, resulting in safer conditions for all those involved whether directly or indirectly and a quicker return to normal traffic conditions."

Although the traffic capability is available to provide the "perfect" response plan described above, in reality due to budget and resource problems day-to-day operating practice falls short of "perfection".

Nevertheless, Toronto is a good example of where "partial" integration of traffic systems has occurred.

There are many good reasons for integrating traffic management capabilities. Foremost, integration serves to consolidate systems, which would otherwise be isolated. Integration thereby allows for the co-ordination of activities and enables each system to take into account the operations, strategies and capabilities of the other systems. Motorists, perceiving the road network as a seamless continuum, benefit from an integrated system, which presents a unified package of information to assist them in making decisions such as route choice and departure time. Integrating several systems with familiar functions enables operational efficiencies within the overall system. Interactions with external agencies are simplified and improved by providing a single point of contact with each source/user agency. Finally, by facilitating intensive cross-communication and cross-support among the linked traffic management systems, integration promotes synergy.

The success stories of the past 25 years (and there are many of them) have resulted from the industry focusing on Freeways/Expressways. The challenge is now to expand this capability to our urban arterials to solve the types of problems discussed in the next two chapters, all in an effort to achieve seamless integration covering the entire network.

Chapter 4 – Special Event Traffic Management Plans

Overall, in the City of Toronto there are approximately 20 major special events every year, which take place geographically throughout the City, and which result in major economic benefit to the City, at the cost of some degree of disruption to the traveling public. Six of these events (called "Signature Events") take place in the area of Lake Shore Boulevard/Exhibition Place/Ontario Place which is located on the north shore of Lake Ontario immediately west of the downtown area. The six signature events are as follows:

Ride for Heart Cycling Event (1 Sunday, all day, June)
International Fireworks Competition (evenings; 2 Wednesdays 4 Saturdays, 1 Sunday, June, July)

Molson Indy (1 weekend, July)
Caribana Parade (1 Saturday, all day, August)
Canadian National Exhibition (17 days at the end of August, finishing on Labour Day)
Canadian International Marathon (1 Sunday, all day, October)

Staff implement a number of traffic and parking regulations on various streets, in the vicinity of Exhibition Place/Ontario Place, which are impacted by the above-noted six signature events. Having regard for the high volume of vehicle and pedestrian traffic generated during these events, the temporal traffic/parking regulations help maintain safe and efficient traffic conditions in the general area while attempting to minimize the impacts on local residents.

The coordinated traffic management plans for these events are managed by an inter-agency working group consisting of Toronto Transportation staff, Toronto Police Service, Toronto Transit Commission (T.T.C.) and Exhibition and Ontario Place staff in order to manage the daily crowds of more than 100,000 expected to attend these events.

During 1999 and 2000, a new traffic management strategy was introduced to manage these signature events including:

- Through traffic management with F.G. Gardiner Expressway ramp closures to separate through traffic from local traffic.
- Utilization of RESCU Traffic Situation Room
  - monitoring situation through cameras;
  - informing drivers of traffic flow updates on overhead CMS's (Changeable Message Signs);
  - providing media with up-to-the-minute road condition reports.
- Transit first traffic management plan
  - selected full street closures to help discourage downtown traffic by giving road priority to transit vehicles;
  - placement of construction barrels and cones adjacent to centre lanes on selected streets to reserve these lanes for exclusive use by streetcars and emergency vehicles, with motorists permitted to use only the curb lanes.
- Emergency response plan – Fire, Ambulance, and Police Services on duty within grounds more than 70 Police Officers stationed at signalized intersections and strategic points along the Expressway to assist with traffic flow and pedestrian safety;
  - ramp closures to also ensure emergency vehicles quick response access;
  - tow trucks to remove any unlawfully parked vehicles that Police determine to be obstructing traffic.
- Traffic signal timing adjustments – to better suit the highly variable traffic flow patterns.

One important proposal, which was not included in the new traffic management strategy, involved prohibiting stopping on both sides of a major downtown arterial, from 9:30 p.m. to 1:00 a.m., on event nights. Given that there are several different dates for the various events, each event would require its own signs, requiring the manufacture of date specific signs to give effect to the regulation. Conservative estimates for the manufacture of signs for each date specific regulatory change would be in the order of 300 – 400 signs per event date.

In addition to the logistical problems associated with the manufacture of this number of signs, there are also personnel implications associated with the installation and removal of these signs and bagging of parking meters on this section of the major arterial.

The estimated cost for this regulatory change would have been approximately $35,000.00 per event date. Therefore, this proposal was not pursued.

A post-implementation review of "Transit First" Traffic Management Plan revealed that significant benefits had been achieved.

The transit fleet realized significant reductions in round trip times for the Bathurst streetcar. Transit staff advised that an average round trip, Exhibition Place to Bathurst Station and back, for the Bathurst Streetcar was approximately 50 minutes. Prior to the implementation of this plan, round trip times on event nights had been as high as 160 minutes.

Ontario Place and Exhibition Place staff advised that their on-site parking facilities had never cleared as fast as they do now under this plan.

Additionally, where traffic had previously remained gridlocked until as late as 2:00 a.m. on event nights, normal traffic operations had resumed by 12:15 a.m. on average. This was due in large part to the presence of Police Officers at key intersections, additional parking enforcement officers with tow-trucks patrolling Lake Shore Boulevard and the use of the freeway management system, RESCU.

The inter-agency working group met after each event to modify the traffic management plan as needed. Other examples of Traffic Management Plans for special events are presented as follows:

Appendix 1. Molson Indy
Appendix 2. Ride for Heart
Appendix 3. Marathons
Appendix 4. Millennium Celebrations
Appendix 5. World Youth Day

Chapter 5 – Construction Traffic Management Plans

In recent years, there has been an unprecedented amount of construction and development work occurring in the City, particularly in the downtown core.

From a construction and maintenance perspective, the road and bridge infrastructure in the City of Toronto is approaching 50 years of service resulting in a bulge of activity over the next five to ten years to keep the infrastructure in a state of good repair. In every segment of the City, the arrival of spring signals the start of road construction, road resurfacing and bridge rehabilitation projects.

In the development industry, lot coverage for many of the proposed buildings is approaching 100 percent and developers are requesting that their construction staging areas be facilitated either

entirely or in part on the public highways adjacent to their properties. Those projects that require (when there is no option) the entire staging area to be created on-street are given 24 hours per day for the duration of the project. Those that do not, often still require the use of public highways to facilitate the hoisting of construction materials and equipment during off-peak hours.

It is therefore of critical importance to motorists, businesses and transit that the construction, maintenance and development projects noted above be tightly monitored and that the work be coordinated so as not to occur concurrently. Additionally, unscheduled (non-emergency) long term road occupation and last minute special events are discouraged wherever possible, in order not to conflict with the already full schedule of special event and construction activity.

The traditional approach involving "Traffic Management Plan" development, approval and implementation followed by field supervision has been applied for many years. An example of the traditional approach involving a contract, which was awarded for the dismantling of the east section of the F.G. Gardiner Expressway follows. The dismantling project was divided into three stages. Stage 1 involved minor road improvements and rail-track relocations. Stage 2 and Stage 3 involved detouring eastbound and westbound Lake Shore Boulevard East traffic.

The traffic management plan consisted of the following elements:

- Installation of temporary traffic control signals
- Lane designations
- Pedestrian crossing prohibitions
- Parking regulations
- Turn prohibitions
- Right-turn-on-red prohibitions
- U-turn prohibitions
- F.G. Gardiner Expressway speed reduction
- Signs were placed well in advance of the construction advising motorists of the detour route.
- Portable variable message boards were employed to convey messages based on real-time traffic monitoring (RESCU) in this vicinity for motorists' information
- Installation of temporary CCTV cameras.

During public meetings held for the dismantling project, some residents expressed concern with the existing volume of truck traffic. Local traffic infiltration was monitored on an ongoing basis and appropriate measures to deter motorists from using local streets were implemented.

The monitoring and response program, which included traffic data collection and analysis, was supplemented by real-time traffic signal control along the detour route, enhanced video surveillance and variable message signs.

However, experience has shown that we need to improve on this traditional approach. Therefore, the following new measures are being implemented in the City to mitigate the effects of construction and maintenance activities on adjacent properties and businesses.

(a) Detailed Pre-Engineering Analysis to Avoid Delays in the Field

One of the factors that has affected the timing and construction staging of our projects is the discovery of unexpected conditions in the field. This can include utility plant not known to have been in the right of way, utility plant that is unexpectedly deteriorated or plant that is not in the place the Utility Company indicated it was. Similarly, it is not unusual to encounter differences in City infrastructure from what is on as-built drawings, plans, and maps.

The discovery in the field of unanticipated conditions such as those mentioned above results in delays to construction as new designs or construction techniques are developed and implemented. The contractor will sometimes develop new staging plans to be able to keep moving on the project, but it can be difficult to catch up to the initial timetable.

There are two solutions to this problem. First, early development and approval of the Capital Works Program would allow time to be allocated to detailed soils analysis, test pits utility circulations and stakeouts. Resources expended on this activity will not only result in better cost control but also in reduced community impact. Second, the utility companies must be urged to thoroughly review the City's plans to accurately identify the constraints imposed on City work by utility plant.

(b) Prequalification of Contractors to Avoid Disappointments in Field Performance

Qualification clauses for contractors, in keeping with the City's purchasing policies, are included in construction tenders issued for competitive bids whenever it is feasible. This measure helps to ensure that the successful contractor has the workforce, equipment and experience to carry out the jobs with as little disruption as possible. Once the contractor has been awarded the job, he is required to submit a detailed implementation plan to ensure that disruption is minimized.

(c) Early Communication with the Community to Minimize Disruption

A community consultation plan for construction projects has been developed with the underlying philosophy that early communication with the community is of paramount importance. Early communication about the nature, scope and timing of the work allows for the City and community to work together to optimize construction timing and staging.

(d) Ongoing Communication with the Community Enables Fast Responses to Problems

Our most successful projects have included the establishment of Construction Liaison Committees consisting of the affected businesses/residents, City field staff and the contractor. These committees are established before the work begins and typically consist of the pre-set weekly meetings in the construction trailer and whatever additional meetings or discussions are needed. They provide the contacts and a forum to allow for the field staff and community to have an ongoing discussion of issues of concern, and to stress the need to maintain traffic movement.

(e) Claims Procedure

The City has a claims process whereby business loss or property damage claims that are appropriately justified can be paid by those responsible. City contracts require the contractors to indemnify and hold harmless the City from loss and damage and to be responsible for the consequences of their work. Contractors are required to carry appropriate levels of insurance to ensure of a financial means to make required payments. The City's claims process monitors contractor's diligence in attending to any resultant claims and if a contractor fails to meet its obligations to the public. City staff are promptly notified so corrective action can be taken. Such corrective action might involve utilizing financial guarantees provided by the contractor and held by the City.

Chapter 6 - RoDARS

The need for an operational tool to better co-ordinate planned road disruptions, as well as respond to unplanned road disruptions, became abundantly clear to both staff and the general public as more and more conflicting events were occurring on-street.

RoDARS (Road Disruption Activity Reporting System) including both the software package and the accompanying procedures was developed for the following reasons:

- need for better co-ordination of road disruption activities.
- need for timely and accurate road disruption information.
- need to easily and quickly disseminate information.
- need for many parties to access the information in a variety of ways – location, date, etc.

RoDARS manages and reports information on activities such as construction, maintenance and special events, which restrict traffic flow on City of Toronto roadways. RoDARS contains information on all Toronto Transportation construction and maintenance activities and can access information on special events, utility construction and development-related construction through other Toronto Transportation databases.

In response to mounting criticism from the traveling public, opportunities for improving co-ordination procedures were identified, including:

- establishing a common database for all road disruption activity information;
- defining responsibilities for ensuring information is kept current;
- obtaining confirmation of the start and end of on-road activities for Dispatch;
- improving capture of road disruptions caused by contracted traffic control maintenance;
- obtaining better, more consistent information on road configuration before and during road disruption activities;
- providing more complete and current information to "Roady Knowall" (Road Information Telephone Service) and emergency services;
- eliminating the use of different documents for essentially the same purpose (e.g. the Complete/Partial Road Closure Report and the 48-Hour Notice);

- for each document, adopting a single, consistent format suitable for its intended use (e.g. eliminating the "fine print" on forms intended to be faxed to Dispatch);
- adopting common terminology for use in all documents;
- automating some report generation and distribution functions to reduce dispatcher workload and improve document quality and consistency.

The RoDARS procedures use three forms for information collection. The RoDARS Description Form (Exhibit 1) is to be used for the initial entry of the project information into RoDARS. The RoDARS Restriction Notice (Exhibit 2) is to be used by site inspectors, consultants and contractors to send information on road restrictions to Road Operations Dispatch. A similar form, the Road Allowance Control System (RACS) Restriction Notice (Exhibit 3) is to be used by utilities, developers and special event coordinators to submit RACS permit activation information.

The Restriction Notice forms have to be submitted in advance of the expected start of the activity on the road. The minimum amount of advance notice required will vary depending on the type of activity and its significance.

- high significance special event, utility cut and Toronto Transportation construction project activities – at least seven days;
- medium or low significance special event, utility cut and Toronto Transportation construction project activities – at least two days;
- high significance Toronto Transportation road or traffic maintenance activities – as soon as the expected activity is defined (medium and low significance activities are not reported).

Exhibit 1

Transportation **RoDARS Description Form**

Activity (Project) Title:

Activity (Contract) Number (e.g., T-10-97 or T-00-00-11):

Activity Source*:

Activity Program Manager*:

Location: ***Schedule:***

Road:

From/At:

To:

From Date: ☐Actual ☐Planned

To Date: ☐Actual ☐Planned

District Number:

Road Classification: ☐ **Expressway** ☐ **Arterial** ☐ **Collector** ☐ **Local**

Activity Status: ☐ Planned ☐ Active ☐ Complete ☐ On Hold ☐ Cancelled

Primary Reason for Work*: ***Type of Work*:***

Comments:

Toronto Transportation Department Contact(s): ☐Primary Contact

Name:
Title:
Phone:
Fax:
Cellular/Pager:

Consultant Contact(s): ☐ Primary Contact

Company:
Office Address:
Name:
Title:
Phone:
Fax:
Cellular/Pager:

Contractor Contact(s): ☐ Primary Contact

Company:
Office Address:
Name:
Title:
Phone:
Fax:
Cellular/Pager:

*** See Description List for Available Selection**

Send to Central Dispatch (Fax No. 392-3749)

Description List

Select the most appropriate category and description from the following list and enter in the designated spaces on the RoDARS Description Form and Restriction Notice.

Activity Source

- Transportation Construction
- Transportation Road Maintenance
- Transportation Traffic Control Maintenance
- Major Special Events (to provide advance tracking prior to RACS permit)
- Major Construction; not Transportation (to provide advance tracking prior to RACS permit)

Restriction Operation

Vehicle Lanes
- No vehicle passage
- Emergency vehicle passage only
- Passage in one direction only
- Passage in both directions

Cross Street
- No access or egress
- Limited access or egress

Bicycle Lanes
- Not available
- Available one direction only

Sidewalks
- Not available
- Available one side only

Activity Program Manager

Transportation Services
- District 1
- District 2
- District 3
- District 4
- Systems
- Planning & Programming

Technical Services
- District 1
- District 2
- District 3
- District 4
- Bridges
- Major Plants

Water & Waste Water
- District 1
- District 2
- District 3
- District 4
- Programming

Solid Waste
- District 1
- District 2
- District 3
- District 4
- Programming

Primary Reason for Work

- Intersection
- Roadway
- Traffic Signal
- Bridge
- Roadside
- Water Main
- Sewer
- Utility
- TTC
- Other

Type of Work

- Reconstruction
- Resurfacing
- Rehabilitation
- Maintenance
- Local Improvement
- Other

Exhibit 3

Transportation **RACS Restriction Notice**

Project Title:

Permit Number:

Emergency Contact (24 Hours/Day, 7 Days/Week):

Name: Company:

Phone Numbers(specify type):

Toronto Inspector:

Name: Phone Numbers(specify type):

Traffic Restriction:

Location		***Diagram and/or Description***
Road: From/At: To:		
Schedule		
Start Date:	End Date:	
Type of closure:	☐ Continuous ☐ Weekdays only ☐ Weekends only	
Start Time (24-hour clock):	End Time (24-hour clock):	show total lanes, lanes closed & traffic directions ↑N

Project Status: ☐ Active ☐ Complete

Comments:

Name:	Phone:
Company:	Fax:
Signature:	Date/Time:

* See Description List for Available Selection

Fax to Central Dispatch 392-3749

Call Dispatch at 392-5555 to Confirm Actual Start and End of Restriction

Exhibit 3

Transportation — RACS Restriction Notice

Project Title:

Permit Number:

Emergency Contact (24 Hours/Day, 7 Days/Week):

Name: Company:

Phone Numbers(specify type):

Toronto Inspector:

Name: Phone Numbers(specify type):

Traffic Restriction:

Location		***Diagram and/or Description***
Road: From/At: To:		
Schedule		
Start Date:	End Date:	
Type of closure:	☐ Continuous ☐ Weekdays only ☐ Weekends only	
Start Time (24-hour clock):	End Time (24-hour clock):	show total lanes, lanes closed & traffic directions

Project Status: ☐ Active ☐ Complete

Comments:

Submitted By:

Name:	Phone:
Company:	Fax:
Signature:	Date/Time:

Fax to Toronto Transportation Road Allowance Control 392-9317

Call Dispatch at 392-5555 to Confirm Actual Start and End of Restriction

The City of Toronto amalgamation process (seven governments amalgamated into one) has somewhat interrupted the full and successful deployment of RoDARS. However, partial success has been achieved in the following areas:

- better data integration.
- better data management.
- better scheduling.
- better tracking.
- better information.
- better decision making

Chapter 7 – Film Industry

The City of Toronto Council adopted six core principles as the foundation upon which future Council decisions regarding the film industry will be based:

(a) Consistent process, across all of the former municipalities and by departments in terms of information required from the film companies, costs charged and applications completed;

(b) Clarified accountability, so that everyone understands who is responsible for approving permits and issuing them;

(c) Customer service, as approved by Council, there must be "one stop shopping" for the film industry with the Toronto Film and Television Office being the point of contact for all film companies working in Toronto;

(d) Competitive in the marketplace, so that Toronto can continue to be a location of choice for those in the film industry;

(e) Cost effective, in terms of costs of doing business both for the film industry and for the City of Toronto;

(f) Citizen sensitive, to allow the interests of citizens and businesses to be understood and included as part of the film permitting and approval process. This sensitivity should include the current methods to inform residents and businesses of filming in their neighborhoods, and a proactive way to obtain input and respond to concerns, as part of an ongoing review of film practices and policies.

Toronto City Council decided to support the growth of the film industry in Toronto because of the significant employment, market profile, and assessment benefits the City receives.

The film and television industry is an important economic sector in Toronto. The industry supports 35,000 jobs in the City of Toronto. Production companies spent approximately $1.2 billion dollars and millions of dollars are paid in property taxes by film and television businesses. In addition, the industry contributes prestige and recognition for Toronto globally, which assists other sectors and the local economy.

City departments, agencies, boards, and commissions are able to generate benefits for their operations from filming activities. For example, it is estimated that the payment for pay duty officers serving the industry is $3.5 million annually. The Toronto Police Service charges a 15 percent administration fee for performing this function, which translates into $575,000.00.

Revenues for the City are realized in two additional ways – parking charges and property taxes from the industry. More importantly, City Council believes that a healthy film industry in Toronto creates jobs enabling our residents a good quality of life and an ability to pay their own property taxes.

By adopting the parking charge method versus the permit charge method, it allows Toronto to promote the "no fee" policy as a competitive advantage, in a fiercely competitive environment both south of the border and across Canada which will help efforts to maintain the City's position as Hollywood North. The detailed guidelines for filming on streets in the City of Toronto are presented in Appendix 6.

The question may be asked: With this "thundering" endorsement of the film industry's economic benefit to the City of Toronto, how is it possible to minimize disruption? That is a good question!!

Exhibit 4 presents the "Parking/Standing/Stopping" guidelines that are prescribed for the film industry's production vehicles. Enforcement of these regulations is sporadic at best.

Chapter 8 – Telecommunications Industry

For many years, the City of Toronto has had an orderly process with which to deal with public utility companies operating within its borders, and to co-ordinate the installation of plant and equipment in the public rights-of-way (ROW). This process worked very well in the era of monopoly utility service provision.

The Canadian telecommunications sector has since been de-regulated by the federal government, and currently operates within a competitive environment. Over the past year and a half, the City has received applications from numerous telecommunications companies to install new plant in the public ROW. In many instances, the area or routings of interest to companies are already experiencing utility congestion. The City currently requires new entrants into the public ROW to enter into Municipal Access Agreements (MAA). A fundamental principle in the MAA is that applications are required to be made for construction in the ROW, and that permits are required to be issued prior to commencement of construction. The same requirements apply to all existing utilities. In addition, all companies with plant in the public highway are encouraged to join the Toronto Public Utilities Coordinating Committee, in order to plan maintenance and installation activities collaboratively with other right of way users.

Exhibit 4

Production vehicles must be parked on City of Toronto Streets in compliance with the following Traffic Prohibitions	
OBJECT	**NO STOPPING, NO STANDING, NO PARKING[1] WITHIN:**
Bridge / Underpass	No Stopping, No Standing, No Parking
Bus Stop[2]	18.5 metres prior to Bus Stop - in direction of travel 30.5 metres beyond Bus Stop - in opposite direction of travel
TTC Streetcar Stop[3] Road width 16.5 metres or less Road width 16.5 metres or more	15 metres prior to Streetcar Stop – in direction of travel 36.5 metres beyond Streetcar Stop – in opposite direction of travel 24.5 metres beyond Streetcar Stop – in opposite direction of travel
Corner	9 metres - if not signed 15 metres - if signed
Pedestrian Cross Walk	18.5 metres prior to Cross Walk - in direction of travel 30.5 metres beyond Cross Walk - in opposite direction of travel
Dead End	9 metres - if not posted 15 metres - if posted
Fire Hall[4]	7.5 metres from entrance – same side of street 30.5 metres – opposite side of street (to permit turning radius)
Fire Hydrant	3 metres
Ramp	0.6 metres
Railway Tracks (Not TTC)	15 metres
Safety Zone (TTC Island)	15 metres
Traffic Lights	15 metres – with a Paid Duty Officer in intersection 30.5 metres – without a Paid Duty Officer in intersection
Tee-Type Intersection	Minimum 9 metres or as signed

Given the number of new entrants to the ROW that have approached the City, it has become apparent that key co-ordination and logistical concerns must be addressed. Multiple companies have been interested in the same routings. While it is in no one's interest to have the same

[1] Unless otherwise currently signed/posted to the contrary by City of Toronto Works & Emergency Services
[2] TTC / Go Transit may approve exceptions or may elect to relocate Bus Stop at the expense of Production
[3] TTC may approve exceptions or may elect to relocate Streetcar Stop at the expense of Production
[4] Fire Department may approve exceptions

streets dug up over and over, the City is sensitive to the fact that the companies may be under significant time pressures to install their networks.

The City's goals include ensuring that its interests are protected, along with the interests of the community and the utilities that occupy the ROW. The City's interests are summarized as follows:

- Construction must be undertaken in a manner that results in as little disruption as possible to the streets, abutting businesses and road users. Sequential digging in the same streets should be avoided;
- New infrastructure must be installed in a coordinated manner in locations that minimize ongoing maintenance and operational impacts on all utility/service providers. Multiple telecommunications corridors through a single cross-section of street should be minimized; and
- It has been a long-standing practice that major damage to new pavement structures is to be avoided (five years for reconstructed facilities, three years for overlaid pavements).

There are a number of alternative ways available to telecommunications companies to pursue the interests of the City in the context of companies' requirements to install their networks as efficiently and as cost effectively as possible. The idea of a common duct structure is only one possible solution. The viability of such a plan will be influenced by many factors, including other available ROW management techniques, other network deployment options (leased fibre, existing conduits, other corridors, wireless, etc.), and regulatory issues. Possible future intervention by the CRTC to permit carriers to construct outside a common duct or the application of terms and conditions of use cannot be ruled out.

The explosion of the telecommunications industry is presenting new challenges to staff as they develop plans and procedures to find an appropriate balance between encouraging economic investment while at the same time minimizing disruption.

The City is currently reviewing responses to a "Request for Proposals" that was issued to "Design/Build/Operate/Maintain/Manage a common support structure system for multiple telecommunications networks in the City of Toronto.

Chapter 9 – Emergency Response Plans

During January 1999, the City of Toronto received 118.4 cm of snow, the largest accumulation of snow in any month since weather records have been maintained. The average yearly snowfall for the City is 130 cm. Within a two-week period in January 1999, the City declared three snow emergencies. The last snow emergency prior to 1999 occurred in 1983.

The snowfall caused significant traffic problems and adversely affected many businesses across the city. Consequently, there was widespread public and political concern with respect to the snow clearing efforts. Although the main arterial roads were kept open, residential streets in the City core were made impassable due to heavy snow accumulations.

The timing of the heavy snowfalls happened at a time when the City was dealing with a number of transitional issues resulting from the amalgamation. In January 1999, no coordinated snow plan existed to address the City's regular winter maintenance activities. Each former municipality had its own snow plan to deal with regular winter maintenance activities. In addition, there were different levels of service, particularly relating to sidewalk clearing and the clearing of driveway windrows. Many key staff had retired, taking with them knowledge of operating procedures.

During 1998, some joint planning meetings were held by Road Operations staff. However, it was decided that winter operations would not change significantly during the 1998/1999 – winter season due to existing contract commitments and the delay in reorganizing. Prior to January 1999, no emergency plan was in place to address heavy snow accumulations.

During the January 1999 snowstorms, a Central Command Centre was set up at the Traffic Management Centre to co-ordinate the snow clearing and removal operation for the entire City. A team of senior staff, under the leadership of a Director, developed and implemented a Winter Storm Emergency Plan. The plan provides an organizational framework and defines the roles and responsibilities of operational personnel in the event of another winter storm emergency.

Subsequent to the January 1999 snowfalls, a comprehensive and standardized winter control plan was developed and approved by City Council. This Snow Plan includes the Winter Storm Emergency Plan, a Snow Removal Plan and a Communications Plan.

The Snow Plan describes the level of service standards that would be provided across the City. These standards were developed by Transportation staff based on analysis of best practices in other jurisdictions and were approved by City Council. Based on these standards, the deployment of staff and equipment will vary depending on the road category and storm conditions. For example, expressways are maintained at bare pavement conditions and plowing is started after 2½to 5 cm accumulation of snow. Residential streets must only be safe and passable and therefore are not ploughed until snow accumulations reach 8 cm. Consequently, the current Snow Plan attempts to achieve an acceptable balance of safety, traffic flow and environmental considerations, at minimum cost to the City.

During the 25 month period after the "Snow Storm", the City encountered a number of additional emergency situations, all of which resulted in severe disruptions, as follows:

Emergency Situation	Dates
Snow Storm of the "Century"	January / February, 1999
Hydro Strike	February 25 – March 3, 1999
Hydro Y2K Major Test (Manby Transformer Station)	March 6, 1999
Toronto Transit Commission Strike	April 19 & 20, 1999
Y2K Major Test (leap year) (Manby Transformer Station)	May 4, 1999
Local 416 (outside workers) Threatened Strike	September 1999
Y2K Alert	December 30, 1999 – January 7, 2000
Y2K (leap year) Alert	February 26, 2000 – March 3, 2000
Local 79(inside workers) Strike	March 30 – April 10, 2000
Major Storm Event (Bridge/Road erosion caused by water flows)	May 12 & 13, 2000
Hydro threat of Strike	February 14, 2001

As a result of this extensive "emergency situation" experience, a generic blueprint was developed to help staff create, test and implement Contingency Plans for a number of emergency scenarios that may impact the Transportation Division.

For scenarios where service to the City is denied due to external events (e.g. a snow storm, heavy rains, an ice storm, a major hydro outage, a major Bell outage, etc.), an action plan is to be completed describing the steps required to recover business functions to the minimum guaranteed level and beyond.

Within Transportation Services there are a number of scenarios for which Contingency and Business Continuity Plans have been or should be developed, implemented and tested. At present there are plans of varying completeness for the following scenarios:

- Labour Disruptions relating to Local 416 and Local 79
- Labour Disruptions relating to Transit Authority
- Snow Emergency
- Hydro Outage
- Bell Canada Outage
- Flooding

Plans to cover the following scenarios are being prepared or refined and will be completed in the near future:

- Ice Storm
- Hazardous Chemical Spill
- Sabotage
- Terrorism
- Major Fire or Gas Main Disruption

The details of the generic blueprint are presented in Appendix 7.

In addition, guidelines are in place granting authority to staff to take action for operational emergencies as follows:

1. The in-charge person is authorized to undertake appropriate and necessary action when an unexpected incident occurs that places the public or City infrastructure in immediate or imminent danger where:
   (a) in the best judgment of the in-charge person, immediate action is required to:
   - protect the public by securing the location through signs, barricades, etc.;
   - notify the public, through Dispatch, of the location and required public actions such as traffic re-routing, area avoidance, etc.;
   - identify the source and scope of problem; and
   - initiate actions to stabilize conditions, including temporary repairs;

   and

   (b) the in-charge person is unable to immediately contact the Director/General Manager/Executive Director and/or the Commissioner to request that an emergency be declared by the Commissioner and/or the Chief Administrative Officer.

2. When the above conditions occur:
   (a) the in-charge person is authorized to:
   - call out appropriate staff;
   - retain appropriate contracting staff; and
   - purchase necessary supplies.

   to achieve 1(a) above

   and

   (b) the in-charge person will report to the Director/General Manager/Executive Director and/or Commissioner as soon as practicable with the details of the incident and all actions that were taken, and proceed with an evaluation of the solution options which may include the engagement of consultant assistance.

Chapter 10 – Concluding Comments

On an annual basis, the City of Toronto streets accommodate the following activities.

Description	1999	2000
Special events	500	299
Races resulting in extensive street closures	15	20
Parades	300	332
Film permits	5000	4131
Hoisting by mobile crane (no road closure)	242	460
Hoisting by mobile crane involving full road closure	53	91
Boom truck hoisting	62	207
New locations for tower cranes	15	60

The Capital Works Programs for Transportation Services and the various utility companies also result in extensive road capacity disruption.

There is no doubt that the combined annual construction programs and increasing number of events, races, parades, and filming activities represent a serious potential for disrupting access and routing alternatives that can affect business and tourism.

Therefore, Transportation staff are under considerable pressure to find better methods to communicate and mitigate the impacts of such activities.

Some new initiatives being implemented or under consideration are:

1. Portable "Technology"

Expanded use of trailer mounted changeable message signs and temporary cameras to provide better information to the "Command Post" for monitoring and operational decision making.

2. RESCU Expansion

Expansion of RESCU all the way up the Don Valley Parkway to Highway 401 (Province of Ontario COMPASS System). Expansion of RESCU westwards from the Humber River to the QEW/Highway 427 Interchange (Province of Ontario COMPASS System).

3. Arterial Cameras

Application of video coverage to the major urban arterials with linkage back to the Traffic Management Centre.

4. Centre-to-Centre Communications Links

Establishment of communications and protocols between the following Traffic Management Centres.

- COMPASS (Province of Ontario 400 Series Highways)
- RESCU
- Toronto Transit Commission

- GO Transit
- Police
- Fire
- Ambulance

5. Arterial Incident Detection/Travel Time Data

Initiation of pilot project to gather travel time data from vehicles equipped with transponders for Highway 407 Express Toll Road. Real time travel data will be excellent for monitoring on-street performance and providing information on alternative routes.

6. Quick Clearance Protocol

Joint development with Emergency Services of Quick Clearance Protocols for all incidents/collisions/spills to return roadways to full capacity as quickly as possible.

7. Role of Patrollers and Inspectors

Changing the patrol and inspection roles to provide a patrol frequency that is consistent and uniform across the City based on the newly adopted road classification system. Development of "Best Patrol and Inspection Practices" to minimize "risk". Development of wireless systems to monitor patrol functions and process service requests.

8. Municipal Law Enforcement Officers

Deputizing transit route Supervisors as MLEO's to co-ordinate relocation ("friendly tows") of any vehicles impeding the movement of streetcars or snow removal operations on those routes.

9. Command Post

Creation of an expanded Command Post suitable for emergency situations.

10. Communications Strategy

Improving communications methods for the public, politicians and media based on monthly press releases including:

- Map of construction projects for the month
- Details outlining the potential impact of each project by highlighting the nature of the project, need and extent of road to be closed, dates of closure, what is being done to alleviate the problem (detours, signal modifications, etc.), etc.
- Superimposed depiction of special events that will take place during the same period
- Additional information to be provided through RESCU and "Roady Knowall"
- Name of contact/spokesperson
- For large projects have a tour with the press to explain the nature of the project and whit it is required

11. Traffic Management Plan Scenarios

Developing guidelines for the various elements of traffic management plans, namely:

- Pre-event activities
- Detour design
- Signing
- Signal operations
- Information dissemination

A first draft of the guidelines is presented in Appendix 8.

The bottom line is we have achieved much ..... but there remains much to be achieved.

Thanks to Martin Maguire, Manager of RESCU, City of Toronto and Ron Stewart of IBI Group for their peer review of an earlier draft of this paper. Also, thanks to the many writers of the many reports to City Council from which I copiously borrowed.

Appendix 1 – Molson Indy

This event is scheduled for mid-July each year and has a peak daytime attendance estimated at 75,000. The documentation (see table at end of Appendix 1) which is submitted each year addresses the obligations of Molstar Sports and Entertainment related to such aspects as the transportation plan, noise attenuation, community liaison, emergency services and clean-up, among other things. The community consultation process has been established through a Community Liaison Committee comprised of area residents and associations.

In accordance with the existing agreement, the Molson Indy organization is required to submit documentation on or before February 1st each year to address in detail their obligations related to staging of the race. The elements specifically set out in the agreement include:

(1) Attendance;
(2) Traffic/Transit/Parking;
(3) Noise;
(4) Community Liaison;
(5) Operating Plan and Safety;
(6) Law Enforcement;
(7) Set-up/Clean-up;
(8) Emergency Planning; and
(9) Costs/Insurance/Liability.

Staff hold discussions related to the transportation plan and continue to liaise with representatives of Molstar Sports and Entertainment, the Toronto Transit Commission, GO Transit, Exhibition Place, the Emergency Services, as required, to ensure all of the transportation elements of this event are carried out in a comprehensive manner. The plan is "transit oriented", with augmented T.T.C. and GO Transit services and stringent controls on illegal parking in abutting neighborhoods. In terms of community liaison, a post-event meeting is held after each race to discuss any significant problems with the operation.

Regulatory changes to prohibit stopping on certain City streets during the event are routinely applied in conjunction with this event. Recent changes reflect an extension of the proposed regulations to 8:00 p.m. instead of 7:00 p.m., and an extension of the area in which the prohibitions apply, in an effort to minimize post-race congestion and ensure a safe operating area.

During the first week of July, work crews under contract to the event sponsor, supervised by Transportation staff, install the bulk of the barrier wall system needed for the Molson Indy race. No work takes place during the peak commuter periods or during Ontario Place and Exhibition Place peak periods. The installation procedure only requires limited lane restrictions for short periods of time. Once installed, there is little adverse impact on Lake Shore Boulevard West traffic operations. The sections of barrier wall, which tend to restrict normal traffic operations is not installed until the major road closures commence. At 9:00 p.m. on the pre-event Thursday, subject to traffic conditions, Lake Shore Boulevard West, between Strachan Avenue and Ontario Drive is closed to allow completion of the barrier system installation and use of the roadway for

the event. Based on previous years' experience, this portion of Lake Shore Boulevard West is reopened as soon as practicable after the final race, but no later than midnight Sunday.

Access to the closed portions of Lake Shore Boulevard West is restricted to persons accessing Ontario Place, local traffic, emergency vehicles, Transportation staff vehicles and public transit vehicles. Police Officers, assisted by Transportation staff and equipment, control use of all restricted areas.

All costs attributable to this event are borne by the event sponsor.

Molson Indy Documentation	
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Appendix 2
F.G. Gardiner Expressway and Don Valley Parkway Closure
Heart and Stroke Foundation of Ontario 2001 Ride for Heart

Toronto City Council, at its meeting in May 2000, authorized an application on behalf of the Heart and Stroke Association of Ontario, to hold the "2000 Ride for Heart". The route involved closure of the Don Valley Parkway, portions of the F.G. Gardiner Expressway and Lake Shore Boulevard.

Transportation Services is in receipt of a communication (dated September 30, 2000) from Mr. Peter Hart of Hart Productions International, on behalf of the Heart and Stroke Foundation of Ontario, seeking approval to run the "2001 Ride for Heart" on June 3, 2001.

City staff and members of the Toronto Police Service have assessed the proposal and had extensive discussions with Mr. Hart since October 2000 to develop modifications to past years' routing in order to address concerns we have received. Closure of the expressways for such an event requires specific Council approval.

The Heart and Stroke Foundation of Ontario "Ride for Heart" is held annually to raise money for Heart and Stroke research. In the past, portions of Lake Shore Boulevard, F.G. Gardiner Expressway, and all of the Don Valley Parkway have been closed. This is the 14th consecutive year that the event is being staged and it is expected to be the largest to date, involving some 14,000 cyclists, and 1,500 in-line skaters who are expected to raise an estimated $1,500,000.00 for the Heart and Stroke Foundation of Ontario.

Although the event is held on a Sunday, given the extent of the closures of major roads, it has always generated a level of public concern regarding traffic congestion and accessibility to certain parts of the City. Prior to last year, as a result of the routing, portions of the Harbourfront and the downtown core were virtually inaccessible. A number of key modifications were made to the 2000 route involving shifting the participants onto the F.G. Gardiner Expressway. In this matter, the downtown areas north and south of Lake Shore Boulevard were not completely bisected, resulting in a considerable reduction in complaints; however, there were still concerns.

Another key feature of this year's proposal is that all marshalling of participants will occur on Exhibition Place grounds. With the exception of some minor lane restrictions on Lake Shore Boulevard West in this immediate vicinity, this route will be open in its entirety, permitting access to all destinations such as the CN Tower, Toronto Convention Centre, Skydome, etc. By using the expressway, access/egress to Exhibition Place (hosts of the event) and Ontario Place which in the past was severely restricted will now be maintained.

Toronto Transit Commission staff concurs with the 2001 proposed road closures as their bus and streetcar routes will be virtually unaffected.

The closure of the Don Valley Parkway during this event remains unchanged from previous years.

The applicant is responsible for, and has agreed to, extensive public notification and the costs associated with the installation and removal of advance and event day traffic signage, barricades, security and policing services as deemed necessary by the Commissioner of Works and Emergency Services and the Toronto Transit Commission.

Additionally, Transportation staff will activate a telephone answering "hot line" service to receive suggestions or complaints concerning the "2001 Ride for Heart". The "hot line" was successfully tested during 2000 Canadian International Marathon and will be used for all major street events in the future.

It must be recognized that these events, as well as several other major activities undertaken annually, will always have some level of impact, and consequently, traffic congestion cannot be entirely avoided. Clearly Council must weigh these factors against the other civic benefits that such events entail. We are confident that the proposed modifications to the route will mitigate the more serious pressure points experienced in previous years and that improved communications will assist in alerting motorists to the event.

Furthermore, to avoid further congestion, staff will make every effort to withhold the issuance of any further permits on the day of the "2001 Ride for Heart".

Excerpts from
Report to City Council

Appendix 3
Annual Marathons in the City of Toronto

The City of Toronto, for several years, has been host to the Canadian International Marathon, which organizes a full marathon and a half-marathon on Sunday October 15, 2000. Both begin at Mel Lastman Square and travel through the former North York, along Yonge Street finishing at Queen's Park.

Recently, another marathon, the "Waterfront Marathon" received a permit to stage a race scheduled to start at the St. Lawrence Market, running along Lake Shore Boulevard, the Leslie Street Spit, and finishing back at the St. Lawrence Market on Sunday September 24, 2000.

Both organizations applied to Transportation staff for a permit to hold their marathon in the City. The Transportation Division requires organizers to meet specific criteria in order to obtain a permit. Requirements include notification to residents and businesses affected by any road closures. Also, Police Services and other City of Toronto Departments must be consulted regarding traffic disruptions. Transportation staff issue permits when all criteria are met. Having satisfied all necessary requirements, both race organizations received a permit.

Being less than four weeks apart, concerns have arisen regarding the proximity of two marathons so close together. However, there is no by-law in place restricting the number of marathons the City of Toronto can host.

Both event organizers continue to consult with City of Toronto staff regarding the design of their race route, signage and traffic plans, as well as facilitation of meetings with the public.

In the cities of Boston, Chicago, and New York, marathons have become major events which draw runners from all over the world and significantly add to the economic development of the host city. The City of Chicago for example started their marathon five years ago. Since their first marathon, they have had approximately 30,000 participants with an economic impact of $65 to $75 million dollars.

One consideration may be to discuss with both organizers the opportunity to move one marathon to the spring with the other marathon remaining in the fall. This could alleviate the concern regarding the proximity of dates.

However, in conclusion, marathons contribute significantly to the vibrancy of a city as shown in other major cities. Therefore, every effort is being made to provide the necessary support to organizers hosting a marathon in the city to ensure their success.

Excerpts from
Report to City Council

Appendix 4
Millennium/New Years Eve Celebration Traffic Management Plan

A working group comprised of representatives of the Toronto Transit Commission, Toronto Police Service, the Toronto Special Events Office, and Transportation Services has met and continues to meet to develop the implementation of a traffic management plan to deal with the 60,000 to 70,000 anticipated attendees for this event.

To assist with traffic control for this event, Toronto Police have assigned 57 Police Officers to be positioned at every intersection (signalized or otherwise controlled) in the area bounded by Lake Shore Boulevard, Parliament Street, Queens Quay, and Stadium Road. These officers will be directed to close intersections should the need to do so arise in order to avoid vehicular gridlock. There will be 15 parking enforcement officers and a fleet of tow trucks patrolling the Queens Quay/Front Street area tagging and towing all unlawfully parked vehicles to ensure that the road network is available to handle the projected increase in vehicular traffic associated with the anticipated crowd. Toronto Police Service "C" Platoon will also be available to patrol the F.G. Gardiner Expressway to ensure that traffic is kept moving ("C" Platoon availability is subject to their not being called away to attend any serious collision location within the City over the course of the evening).

The Toronto Transit Commission is dedicating 120 buses to operate a shuttle service from Union Station to the event site at Queens Quay and Yonge Street and back, and people are being encouraged to take public transit to and from this event. To assist the T.T.C. in operating this shuttle service, all parking and loading areas will be removed. Police Officers on traffic point duty will also be requested to give priority to buses, to assist in the operation of this shuttle service.

To assist officers on traffic point duty, Transportation staff will be dropping off traffic signs and delineators in advance of the event at all traffic positions. This equipment will be available to the officers to assist them in closing streets/intersections, should the need to do so arise. Transportation staff will also be positioned on the F.G. Gardiner Expressway at off-ramps and will be directed by the Police to close these off-ramps if traffic conditions become critical in the Front Street/Queens Quay area. It is of utmost importance to avoid a traffic gridlock situation in this area to ensure the free passage of Emergency Services vehicles (Police, Ambulance, and Fire) should their services be required.

The event command post will be located at our Traffic Management Centre, thus allowing staff of Toronto Police, T.T.C., and Transportation Services to use the RESCU system in place on the F.G. Gardiner Expressway, Lake Shore Boulevard, and Don Valley Parkway, which provides a live video feed of traffic conditions in the entire area.

A public consultation meeting regarding this event was held on December 7, 1999 at the Harbour Castle Hotel. In attendance at the meeting were representatives of the working group and representatives of the various residents/condominium associations from the Queens Quay area. In the event that road closures other than those scheduled in connection with the event become necessary, every effort will be made to ensure resident/guest ingress/egress during the course of the evening.

The working group will continue to meet to fine tune this plan and deal with other issues as they arise.

Excerpts from
Report to City Council

Appendix 5
World Youth Day/Papal Visit 2002 Transportation Issues

- July 24 to July 29, 2002

- July 24 to July 26
  - Youth events
  - Exhibition Place/Skydome
  - 500,000 youth delegates

- July 28
  - Papal Mass
  - Downsview Airport
  - 1,000,000 attendees

- Virtually no planning to date regarding transportation logistics

- City asked to provide adequate transportation facilities and low-cost transit pass

- Unknowns
  - # registrants
  - Location of billets
  - Modal split i.e. walk, T.T.C., GO Transit, charter bus

- "Olympic" size attendance, however:
  - One site versus many
  - 2 years versus 8 years lead time
  - No additional transit vehicles/infrastructure

- Feasibility of adequate transit service not yet addressed

- Impact on background transit/traffic operations, particularly during weekday peak periods, not yet addressed

- September 1984 papal mass at Downsview Airport (post experience)

- Transportation Committee included several sub-groups:
  - Inter-City Transport – charter buses, regular service
  - Urban Transportation – walk, auto, bus, subway, heavy rail
  - Parking Facilities – public, private
  - Routes and Diversions – signing, internal circulation
  - Background Traffic Reduction – public, private
  - Special Services – VIP's, disabled, emergencies, motorcades
  - Security Co-ordination
  - Air Transport

Appendix 6

TORONTO

Rhonda Silverstone
Film Commissioner

Economic Development, Culture & Tourism
Joe Halstead, Commissioner

Economic Development
Metro Hall, 8th Floor
55 John Street
Toronto, Ontario
M5V 3C6

Email:
info@torontofilmpermits.com

December 11, 2000

Dear Film and Television Industry Member:

I am writing this letter to advise you of some significant changes that will take place in the Toronto Film and Television Office beginning in January 2001.

On October 3, 2000 Toronto City Council adopted a report entitled "Amalgamation of Film Permitting Services". The changes that were approved included:

1. **Creation of one film office and that the Toronto Film and Television Office is the first point of contact for all filming in the City.**
   Beginning January 1, 2001 all film permits for the City of Toronto will be issued by the Toronto Film and Television Office which is located at Toronto City Hall, Main Floor, Rotunda North. Our telephone number is 416-392-7570 and our fax number is 416-392-0675.

2. **Adoption of Cost Replacement policy.**
   Cost replacement policy means that Departments, Agencies, Boards and Commissions will be billing film companies for direct costs incurred and/or established revenues lost as a result of a film shoot. There will be no location fees or administrative overheads.

3. **Charging for use of Toronto Parking Authority parking meters.**
   The Toronto Film and Television Office will be collecting fees for use of the Toronto Parking Authority parking meters as of January 1, 2001. Please note that the amount charged for meters varies throughout the City. Production companies will pay the hourly rate noted on the meter times the number of spaces used. Please note that you will pay meter costs for the time that you are occupying the parking space, which will include coning time. Initially the method of payment will be cash or certified cheques, payable upon receipt of the location-filming permit. Cheques are to be made out to "Treasurer, City of Toronto".

We are also creating a "rate sheet" for the industry. This is a generic price list, which will identify the cost associated with various services (based on Cost Replacement model). It is being jointly developed with relevant departments, agencies, boards and commissions and it will be published on an annual basis.

We look forward to working with you in the future.

Yours truly,

(Original signed by Rhonda Silverstone)

Rhonda Silverstone
Manager
Toronto Film and Television Office

Guidelines for Filming on Streets under the Jurisdiction of the City of Toronto

1. **Applicability:** The following guidelines apply to all location filming which takes place in the City of Toronto, except for current affairs and newscasts.

2. **Permit Issuance:** Permits for location filming will be coordinated through and issued by the Toronto Film and Television Office (TFTO).

3. **Timelines for Submission of Application:** The TFTO will be advised of all location filming requiring a permit, not less than 2 business days in advance of filming or in City Parks, as agreed to between the Parks Division and the TFTO. This does not apply to previously permitted locations where rescheduling is necessary. However, if an alternate shoot date is required and it is not on the permit or is a date other than what is on the permit, a subsequent letter of notification as described in Guideline 4 is required, but the application period is waived. Filming that includes but is not limited to road closures; multi-lane closures and special effects require at least 4 days notice.

4. **Notification:**
   (i) *Community*: The film company must notify affected residents, occupants and businesses, in advance of filming and as instructed by the TFTO, of the duration and location of filming, including information about planned special effects, road and lane closures, sidewalk usage without obstructing pedestrians and the time that cones will be placed on the street to restrict parking. Filming in residential areas for a period of 7 consecutive days or longer will not be approved unless a majority of affected residents (as determined by the TFTO) have given their approval (written approval where possible, name and address of homeowner / tenant, business owner noted if has no objection but does not wish to sign). Filming involving the use of catastrophic special effects will not be approved unless a majority of affected residents (as determined by the TFTO) have given their approval (written approval where possible, name and address of homeowner/tenant, business owner noted if has no objection but does not wish to sign). A Handbook outlining notification procedures is available from the TFTO.

   (ii) *Councillors*: Councillors will be notified on a daily basis after the permit is signed by the applicant. This notification will include the name of the Production Manager, title of the production, telephone number of the production office, the Location Manager and the Location Assistant if requested.

5. **Restrictions on Hours/Days for Filming:** Permits authorizing filming in residential areas between 11:00 p.m. and 7:00 a.m. will not be approved unless all affected residents have been notified in advance. Depending on the potential impact on the area, a majority of affected residents (as determined by the TFTO) will have to give their approval (written approval where possible, name and address of homeowner/tenant, business owner noted if has no objection but does not wish to sign) for filming to occur in these circumstances.

6. **Limitations:** Location filming in residential areas will be limited to 2 occasions/year for each residential block unless approval of a majority of affected residents (as determined by the TFTO) (written approval where possible, name and address of homeowner/tenant noted if has no objection but does not wish to sign) is given for additional occurrences and all notification procedures are followed to the satisfaction of the TFTO. The amount of filming in other areas may also be limited as determined by the TFTO in consultation with Ward Councillor(s).

7. **Consideration to Residents/Occupants/Businesses:** These persons should be free from any negative environmental conditions resulting from filming including but not limited to, spillover lighting, exhaust fumes, or noise that may affect their ability to enjoy their property or conduct their business unless they have been contacted and do not express any objection. Specifically:

   (i) *Lighting:* Lighting for filming should be oriented away from neighboring residences unless residents have been contacted and do not express any objection and should not interfere with the safe movement of traffic. Night filming involving intensive lighting between 11 p.m. and 7 a.m. requires approval of majority of affected residents (written approval where possible, name and address of homeowner/tenant noted if has no objection but does not wish to sign).

   (ii) *Noise*: The production company must comply with legislation governing noise. If the affected residents/occupants/businesses have been advised in advance of the nature of the noise and do not object, the likelihood of a complaint will be reduced.

   (iii) *Generators*: All generators used on streets in residential areas or in City Parks will be "blimped" generators unless otherwise approved.

8. **Disruption to Residents/Occupants/Businesses:** It is the production company's responsibility to ensure that there is a minimum of disruption to residents, occupants, businesses and City employees where filming occurs. This includes ensuring residents, owners and customers access to their respective premises and ensuring pedestrian and vehicular access to adjoining properties. The production company is under no obligation to provide compensation for disruption unless it voluntarily agrees to do so with residents/occupants/businesses or otherwise has legal obligation to do so. Disruption of parking as a result of a film permit is not compensable unless otherwise agreed with the applicable persons. Every effort should be made to ensure that people displaying legitimate credentials such as disabled parking permits are accommodated in recognition of their personal safety.

9. **Identification of Production Vehicles:** All vehicles carrying equipment involved in the production will be issued a Location Filming Vehicle Permission Card which must be displayed on their dashboards and it is the responsibility of the production company to determine in advance, the number of production vehicles requiring such a permit.

10. **Traffic:**

i) No interference with pedestrian or vehicular traffic is to occur without being noted on the permit. Every opportunity is to be taken to ensure that access, either vehicular or pedestrian, is not restricted to persons with disabilities.

ii) Production vehicles must comply with appropriate traffic regulations unless stated otherwise on the permit.

iii) All moving vehicles must comply with regulations governing traffic in City Parks/Properties unless otherwise noted on the permit.

iv) Except where a road is closed for filming, where a moving vehicle is involved, the applicant shall adhere to the posted speed limits and to lawful conditions unless directed otherwise by a Pay Duty Police Officer.

11. **Parking and/or Standing:**

(i) Production vehicles must not block fire hydrants or be parked in fire routes or within 9 metres of an intersecting street or impede any emergency response vehicles and must also adhere to any other requirements specified on the permit.

(ii) In City Parks, production vehicles and equipment must not block driveways or other access/egress ramps. Production vehicles must leave at least two feet clearance on either side of a driveway, ramp, or other accesses/egresses/ingresses. In all other circumstances, vehicles cannot block driveways or other access ramps without the approval of the owner.

(iii) No production equipment/vehicles are to be within 30 metres of a subway entrance, a bus or streetcar stop, a pedestrian crossover or a signalized intersection unless otherwise noted on the permit.

(iv) It is up to the film company to make alternate parking arrangements for residents in possession of a valid street-parking permit for that area whose vehicles are displaced by the filming activity. Relocating vehicles by towing to accommodate filming or parking will not be permitted.

(v) Production vehicles must not block parking lot access/egress ramps and accessible parking for persons with disabilities.

12. **Traffic Stoppages:** Intermittent traffic stoppages to a maximum of 3 minutes, unless stated otherwise, shall be under the supervision of a Pay Duty Police Officer. It is the production company's responsibility to arrange for the Transportation Division to cover, alter, remove and/or reinstall traffic or street signs as may be necessary.

13. **Filming Activities and Relationship to Police/Fire/Ambulance:**

(i) Appropriate Pay Duty Police Officers are required for the detonation of pyrotechnic special effects. A blast analysis may be required and additional time is needed to arrange for this activity. Qualified Emergency Medical Services personnel (paramedics) be on site during the filming of dangerous situations such as special effects, stunts, and /or detonation of pyrotechnics, as determined by the Toronto Film and Television Office.

(ii) The Toronto Fire Department must be advised in advance in writing when the use of flammable liquids/materials is being planned.

(iii) Pay Duty Police Officers are required as determined by the TFTO for such things as permit compliance, intermittent traffic stoppages and traffic control and/or when required to direct pedestrian or vehicular traffic including those instances involving City Parks/Properties. A copy of the permit is to be supplied to the Pay Duty Officer on duty. All costs associated with these requirements are the expense of the applicant.

14. **Clean-up:** Production crews must clean the location at the end of the day with a minimum amount of noise and disruption and ensure that the area is returned to its original condition, unless otherwise approved by the TFTO or other arrangements are made with an operating Division of the City and noted on the permit, in which case the production company will be billed accordingly. Materials and debris are not to be washed into catch basins.

15. **Conduct:** It is the responsibility of the production company to ensure that their staff operate in a safe and professional manner in the course of their duties and adhere to the City of Toronto Code of Conduct for Cast and Crew.

16. **Insurance:** All companies filming in the City of Toronto, must present to the Commissioner of Finance, prior to permit issuance, a certificate of comprehensive general liability insurance in the amount of $2 Million per occurrence or such higher limits as the City of Toronto reasonably requires depending on the nature of filming and all such policies shall add the City of Toronto as an additional insured and shall contain a cross liability clause, a severability of interests clause and shall not call into contribution any other insurance available to the City of Toronto. In addition, such policies may not be cancelled or amended without the prior written consent of the City of Toronto via the TFTO.

17. **Expenses:** The production company is responsible for all out-of-pocket expenses related to the use of City roads, properties, parks or equipment and shall be given an estimate of these costs prior to permitting. Once filming begins or is about to begin, if there are any changes to these arrangements, the production company is to be notified immediately. Whenever expenses are anticipated, the production company will be required to issue a purchase order number to the City to cover these costs and may also be asked to pay in advance.

18. **Security Deposit:** Where deemed necessary by the appropriate City Department/Agency, a certified security deposit shall be required prior to the issuance of a film permit as stipulated on the permit and this deposit shall not be returned until all invoices, charges and claims have been cleared.

19. **Safety:**

(i) Interior safety signs in buildings must not be covered, (e.g., fire exit signs) unless expressly agreed to by the property manager.

(ii) All production companies must adhere to the Ontario Ministry of Labour's Safety Guidelines for the Film & Television Industry in Ontario, 4th Edition - January 1999, and

(iii) The Ontario Ministry of Transportation's Manual of Uniform Traffic Control Devices for Temporary Work Sites. This information is available from the respective Ministries and the TFTO.

20. **Restrictions:**

i) There may be sensitive areas and/or properties in the City of Toronto in which filming may be restricted. Specifically, no filming of 360 University Avenue (United States Consulate).

ii) Filming on controlled access highways such as the Don Valley Parkway and Fred G. Gardiner Expressway requires special consideration.

iii) Decisions about the nature and extent of filming in or around a heritage property will be negotiated on a case-by-case basis with the appropriate municipal heritage officials.

The TFTO reserves the right to refuse to issue a permit to a production company or individual who has failed in the past, to adhere to these guidelines or any filming guidelines of the former municipalities now forming the City of Toronto.

Appendix 7
Blueprint for Preparing Emergency Response Plans

1. Identify and Quantify the Scenario

For each emergency scenario it is necessary to define the parameters under which the contingency plan will be invoked.

2. Define Service Levels Across the Division

For the scenario being considered define the minimum guaranteed service level that can be delivered using city staff and/or contractors taking into consideration any legally required service levels.

3. Identify Staff Assignments Based on Service Levels and Facilities

Based on the service level defined identify the number of staff required to fill the functions necessary to achieve the service level. At the same time define the technical / professional experience level and any other considerations for each function.

4. Quantify Any Staffing Shortfall or Surplus and Formulate An Action Plan

Based on the staff assignments defined above, identify any shortfall or surplus in staffing and, if required, estimate the number and type of staff required from external sources to enable the service level to be met. If necessary re-visit the service level and examine other means of achieving the same service level target such as using contractors. In the event of a surplus notify other Divisions of the number/type of staff available.

5. Identify Facilities With Security Requirements And Staffing Needs if Being Kept Open

For the scenario being examined list all facilities and identify those that must be kept open to deliver the minimum guaranteed service level. Service levels are quite often dependent on vehicles and equipment being available from a particular location. The vehicles and equipment database should have equipment flagged for deployment under each scenario for each location.

6. Equipment and Vehicles

Taking the scenario under investigation and the minimum guaranteed service level identify the numbers and types of equipment and vehicles required to deliver that service level, bearing in mind that some equipment or vehicles may not be available as the site at which they are normally located would be closed.

7. Communications

Under the scenario being considered look at the communications requirements.

8. Databases / Applications

For the scenario under consideration list the databases and applications required to provide the minimum guaranteed service level.

9. IT Requirements

Against each database/application ensure that re-boot instructions together with the appropriate passwords (these should be kept in sealed and signed envelopes in a fireproof container) are in place.

10.Corporate Guidelines / Financial and HR Requirements

Ensure that up to date copies of all corporate guidelines relating to emergency procedures are kept in the Viewing Room on the 5th floor of 703 Don Mills Road.

11.Training Requirements

For the scenario under consideration identify functions for which training is necessary. Identify those staff who have not received such training and arrange for them to attend appropriate courses.

12.Contingency Plan Maintenance

A plan is only useful if it is maintained regularly and tested frequently. Identify a member of staff to keep the plan up to date and check regularly that it is being maintained.

13.Transportation Nerve Centre

For the scenario under consideration it is necessary to decide whether the emergency would get to a point where it would be appropriate to manage it from a central command post. The Control and Viewing Rooms on the 5th floor of 703 Don Mills Road have been designated as the Transportation Nerve Centre. This is separate from the Citywide Emergency Operations Centre on the 6th floor of the same building.

14.Post Implementation Assessment

If the plan is implemented, a post-implementation assessment should be conducted to determine the following:

- whether the plan met expectations
- whether the minimum service levels were met
- whether the staff implementing the plan were satisfied with its implementation
- where, if necessary, the plan should be amended
- the scope of the emergency
- the cost of the emergency in damage, labour, productivity

Appendix 8
TRAFFIC MANAGEMENT PLAN SCENARIOS

ROAD TYPE	SCENARIO	TEMPORAL CHARACTERISTICS
Expressway	E1.	Weekday/Weekend Daytime
	E2.	Weekday/Weekend Overnight
	E3.	Weekend Continuous (continuous is > 8 hours)
	N/A	Weekday Daytime Peak
	N/A	Weekday Continuous
Major Arterial Road	MA1.	Weekday Daytime Peak
	MA2.	Weekday Daytime Off-Peak/ Weekend Daytime
	MA3.	Weekday/ Weekend Overnight
	MA4.	Weekday/ Weekend Continuous
Minor Arterial Road	MI1.	Weekday Daytime Peak
	MI2.	Weekday Daytime Off-Peak/ Weekend Daytime
	MI3.	Weekday/ Weekend Overnight
	MI4.	Weekday/ Weekend Continuous

ROAD TYPE	SCENARIO	TEMPORAL CHARACTERISTICS
Collector Road	C1.	Weekday Daytime Peak
	C2.	Weekday Daytime Off-Peak/ Weekend Daytime
	C3.	Weekday/ Weekend Overnight
	C4.	Weekday/ Weekend Continuous

Local Road	L1.	Weekday Daytime Peak
	L2.	Weekday Daytime Off-Peak/ Weekend Daytime
	L3.	Weekday/ Weekend Overnight
	L4.	Weekday/ Weekend Continuous

TRAFFIC MANAGEMENT PLAN ELEMENTS

A. PLANNING

SCENARIO	PRE-EVENT MEETINGS	WORK ZONE/ TRAFFIC CONTROL/ DETOUR DESIGN DRAWINGS	CENTRAL COMMAND POST
E1	YES	YES	CONSIDER
E2	YES	YES	CONSIDER
E3	YES	YES	CONSIDER
MA1	YES	YES	NO
MA2	YES	YES	NO
MA3	YES	YES	NO
MA4	YES	YES	CONSIDER
MI1	YES	CONSIDER	NO
MI2	YES	NO	NO
MI3	YES	NO	NO
MI4	YES	YES	NO
C1	YES	NO	NO
C2	YES	NO	NO
C3	YES	NO	NO
C4	YES	CONSIDER	NO
L1	YES	NO	NO
L2	YES	NO	NO
L3	YES	NO	NO
L4	YES	NO	NO

TRAFFIC MANAGEMENT PLAN ELEMENTS
B. DETOUR DESIGN

SCENARIO	AREA OF IMPACT	TURN PROHIBITIONS	POLICE ASSISTANCE
E1	YES	NO	NO
E2	YES	NO	NO
E3	YES	CONSIDER	NO
MA1	YES	CONSIDER	YES
MA2	YES	CONSIDER	YES
MA3	YES	CONSIDER	YES
MA4	YES	CONSIDER	YES
MI1	NO	CONSIDER	CONSIDER AT TCS/PXO
MI2	NO	CONSIDER	CONSIDER AT TCS/PXO
MI3	NO	CONSIDER	CONSIDER AT TCS/PXO
MI4	CONSIDER	CONSIDER	CONSIDER AT TCS/PXO
C1	NO	NO	CONSIDER AT TCS/PXO
C2	NO	NO	CONSIDER AT TCS/PXO
C3	NO	NO	CONSIDER AT TCS/PXO
C4	CONSIDER	CONSIDER	CONSIDER AT TCS/PXO
L1	NO	NO	NO
L2	NO	NO	NO
L3	NO	NO	NO
L4	NO	CONSIDER	NO

TRAFFIC MANAGEMENT PLAN ELEMENTS
C. SIGNING

SCENARIO	ROAD CLOSED	PERIMETER ADVISORY	DETOUR SIGNS	CMS/PCMS	MODIFY ATTRACTION SIGNS	MODIFY PARKING SIGNS
E1	YES	YES	YES	YES	NO	N/A
E2	YES	YES	YES	YES	NO	N/A
E3	YES	YES	YES	YES	CONSIDER	N/A
MA1	YES	YES	NO	CONSIDER	NO	NO
MA2	YES	YES	NO	CONSIDER	NO	NO
MA3	YES	YES	NO	CONSIDER	NO	NO
MA4	YES	YES	CONSIDER	YES	YES	CONSIDER
MI1	YES	CONSIDER	NO	NO	NO	NO
MI2	YES	NO	NO	NO	NO	NO
MI3	YES	NO	NO	NO	NO	NO
MI4	YES	YES	CONSIDER	CONSIDER	YES	CONSIDER
C1	YES	NO	NO	NO	NO	NO
C2	YES	NO	NO	NO	NO	NO
C3	YES	NO	NO	NO	NO	NO
C4	YES	CONSIDER	CONSIDER	NO	CONSIDER	CONSIDER
L1	YES	NO	NO	NO	NO	NO
L2	YES	NO	NO	NO	NO	NO
L3	YES	NO	NO	NO	NO	NO
L4	YES	NO	NO	NO	CONSIDER	CONSIDER

TRAFFIC MANAGEMENT PLAN ELEMENTS
D. SIGNAL OPERATIONS

SCENARIO	TIMING & PHASING	HARDWARE MODIFICATIONS	TEMPORARY SIGNALS
E1	YES	NO	NO
E2	YES	NO	NO
E3	YES	CONSIDER	CONSIDER
MA1	CONSIDER	NO	NO
MA2	NO	NO	NO
MA3	NO	NO	NO
MA4	CONSIDER	CONSIDER	CONSIDER
MI1	CONSIDER	NO	NO
MI2	NO	NO	NO
MI3	NO	NO	NO
MI4	CONSIDER	CONSIDER	CONSIDER
C1	NO	NO	NO
C2	NO	NO	NO
C3	NO	NO	NO
C4	CONSIDER	CONSIDER	CONSIDER
L1	NO	NO	NO
L2	NO	NO	NO
L3	NO	NO	NO
L4	CONSIDER	CONSIDER	NO

TRAFFIC MANAGEMENT PLAN ELEMENTS
E. INFORMATION DISSEMINATION

SCENARIO	NOTICES TO MEDIA, STAFF, COUNCILLORS, EMERGENCY SERVICES	WEB SITE	ROADY KNOWALL	BROCHURES	NOTIFY DIRECTLY AFFECTED RESIDENTS/BUSINESSES
E1	YES	YES	YES	NO	YES
E2	YES	YES	YES	NO	YES
E3	YES	YES	YES	CONSIDER	YES
MA1	YES	YES	YES	NO	CONSIDER
MA2	YES	YES	YES	NO	CONSIDER
MA3	YES	YES	YES	NO	CONSIDER
MA4	YES	YES	YES	CONSIDER	CONSIDER
MI1	YES	YES	YES	NO	CONSIDER
MI2	YES	YES	YES	NO	CONSIDER
MI3	YES	YES	YES	NO	CONSIDER
MI4	YES	YES	YES	NO	CONSIDER
C1	YES	YES	YES	NO	CONSIDER
C2	YES	YES	YES	NO	CONSIDER
C3	YES	YES	YES	NO	CONSIDER
C4	YES	YES	YES	NO	CONSIDER
L1	YES	YES	YES	NO	CONSIDER
L2	YES	YES	YES	NO	CONSIDER
L3	YES	YES	YES	NO	CONSIDER
L4	YES	YES	YES	NO	CONSIDER

Performance Measurement and Integrated Transportation Management Systems
-A Traffic Operations Perspective-

John Wolf, California Department of Transportation

A Call To Action

America is on the verge of a revolution in transportation. But, where is Paul Revere warning us of its impending arrival, and who will be our General Washington, someone with an awareness of the lay of the land and an understanding that this war's battles will not be scripted by traditional old world theoreticians. The revolution I refer to is the emergence of Traffic Operations as the critical mobility agent. There are no indicative events comparable to the Stamp Act or the Boston Tea Party to point to, just the pernicious delay and its related uncertainties we all seem to accept, much like many failed to challenge England's restricting rule until our very freedom and basic rights were threatened.

Before I go much further, I must admit that there is a "light in the Old North Church", or at least in Washington, D.C. in the form of the Federal Highway Administration and its leadership in developing an "Operations Vision". As explained by the Federal Highway Administrator to the ITS World Congress in Toronto, this means: "maximizing our investment in our current transportation system and managing the performance of our future infrastructure"; and "delivering integrated services to our customers - whether they are freight shippers, transit user, commuters, tourists or pedestrians". Indeed, Operations itself, will be our General directing future mobility campaigns, and there will be no star traffic operations program in this country, without considerable system management, significant integration, strong partnership and real performance aspects. It is no small challenge to fulfill the vision of people and goods moving freely and safely through a transportation system that is so seamless, it's barely visible.

The New World Order

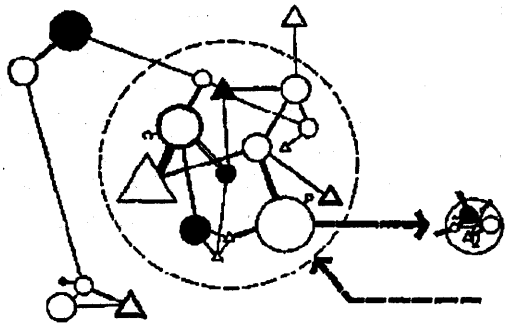
There is no more potent issue driving better system management than the need for performance. There is probably no better short-term payoff for improved system performance than better system management. This paper accepts those statements as truisms and intends to ferret out some issues related to Integrated Transportation Management Systems and system performance by describing the experience in a DOT Traffic Operations Division in California over the last several years in developing system management strategies anchored on performance. The emphasis will be on traffic operations and performance measurement with the intent of showing some of the nuts and bolts of performance measurement – the specific measurements, the data sources, the processes used to develop and implement, and how they are expected to be used.

System Management

First, let us consider the concept of system management. System management is a broad term that can be defined in a variety of ways. In the broadest sense, system management is a view of managing the state transportation system as a whole, including all agencies, resources, employees, customers, stakeholders and the infrastructure. It means that all parts must work together for management of the system to be effective. In a narrower sense, system management is a philosophy about planning, programming, implementing and operating the state transportation system so that the efficiency and effectiveness of the system is improved. System management requires full knowledge of system performance for day-to-day operations as well as for identification of needed improvements.

Often system management can be misunderstood, or at least the focus, if the following systems laws of nature are not considered:

A system is a set of interconnected parts



But each part may be seen as a system itself....

.And the whole system may be regarded but one part of a larger system.....

Source: *Urban & Regional Planning A Systems Approach*

Let's assume that the Transportation System is a whole system and part of a larger system as described above. We can choose to manage at any level or part, e.g. a single program, a single mode, or a single jurisdiction, but unilateral or limited approaches tend to limit the payoff. Our failure to fully incorporate the broader societal goals and interests by looking only at transportation as an end game to itself is ample evidence of the limitations of what amounts to a partial systems approach. In California we are finally beginning to realize we can't "manage" a highway system without integration of other modes, even if, we the highway system operators, don't have jurisdiction in transit etc.

Better management of the existing transportation system dominated by automobiles has been an issue since that domination arose post World War II. Efforts for better system management gave rise to traffic operations functions that had more to do than signing and striping, merely i-dotting

and t-crossing for construction plans. By the time of the freeway revolts of the 60s and 70s, we began to see management concepts emerging in the form of high occupancy lanes, ridesharing, and even signals on freeways (at least on the ramps). More aggressive operations, particularly control oriented efforts, have always met stiff opposition and often advanced only in climates where fiscal or other constraints encouraged non-traditional thinking. At one time highway, now surface transportation, re-authorizations began to require broader system thinking over time, and the post interstate era marked a clear shift to a systems orientation. Such shifts usually engage about as well as tectonic plates do. The upheaval surrounding the federal call for management systems in ISTEA is ample evidence. The shaking did not subside until the mandatory nature was repealed.

Background – the California Context

Caltrans developed Transportation System Performance Measures in 1998 (http:www.dot.ca.gov/hq/tsip/tspm) in conjunction with previous, and in anticipation of future, State Transportation Plan initiatives. In the case of the former this was a recognition of deficiencies, while the later involves an opportunity in the new Plan in 2002 for a more effective document. In reviewing the California experience, you will see the ingredients common to most performance measurement exercises.

The purpose of the California performance measurement effort was twofold:

- To develop indicators/measures to assess the performance of California's multi-modal transportation system **to support informed transportation decisions** by public officials, operators, service providers, and system users (***talk about integration!***)
- To establish a coordinated and cooperative process for consistent performance measurement throughout California (***real integration***)

The goals were:

- To understand the role the transportation system plays in society (***integration that counts***)
- To focus on outcomes at the system level rather than projects and process (performance in the eye of the customer)
- To build transportation system relationships (partners) with clearly defined roles, adequate communication channels, and accountability at all levels
- To better illuminate and integrate transportation system impacts of non-transportation

Some of the impetus for the effort was:

- The Intermodal Surface Transportation Efficiency Act 1991
  - ➢ A system vision - "all forms of transportation in a unified, interconnected manner"
  - ➢ A call for better management with an eye on performance

- The California Transportation Plan 1993
  - ➢ Executive Order - "California's transportation system should be a modern, balanced, **integrated** multi-modal network"
  - ➢ "develop appropriate transportation system performance objectives and measures"
- State statute
  - ➢ "objective criteria for measuring system performance" as part of State Transportation Improvement Program Guidelines

It was critical throughout the process to remind partners what performance measurement was and still is;

- A standard management function to help understand accomplishments
- A planning tool to improve investment analysis
- Customer-oriented as opposed to service provider-driven
- A genuine system perspective, as modally blind as possible
- A lengthy, evolving process
- Very effective if there is a clear purpose and simple set of metrics based on readily obtainable data

and isn't;

- A panacea
- An isolated exercise
- A magical "Black Box"
- Naive over-simplification
- Usurpation of regional authority

The bottom line was quite simple. Performance measures were essential for system management, and an opportunity for stronger, clearer partnerships (also essential to system management), and the right basic business practice.
The intent wasn't to measure an organization's performance, or the performance of any individual mode, program or other sub-system, rather the total transportation system. Of course, in laying out such a broad objective, the relationship between total system performance and other performance becomes very important, especially if integration is to be smooth. Ultimately, all other performance gets harnessed by system performance, a fact that was not necessarily highlighted while developing consensus among various players.

Development of Performance Measures

It is never easy to get statewide agreement on things in California, a diverse state with an economy larger than most national economies, and a political climate equally complex. Statewide planning efforts have always been contentious, and, save the Freeway & Expressway Plan of 1959, few plans have been significant.

Caltrans approached the development of performance measures in a variety of ways to allow for ample stakeholder and decision maker input.

A technical advisory group (Transportation Assessment Steering Committee or TASC) was established to assist in detailed development of system outcomes, indicators, measures, links to decision-making, data collection and terminology. The group consisted of representatives from regional transportation planning organizations, private interest groups, the Federal government and Caltrans programs and districts.

A Policy Advisory Committee (PAC) was convened to provide overall policy guidance and to review and comment on the framework as it developed. The PAC was comprised of almost fifty people representing various public and private interests in the state.

To obtain additional stakeholder perspectives, a two-day conference to specifically address transportation system performance measures was organized and presented by the University of California. Several hundred attendees from across the State representing agencies as large as the Southern California Association of Governments (SCAG) and the Bay Area Metropolitan Transportation Commission (MTC) to small, rural county governments came to Sacramento for the conference.

Government, academic and private industry representatives were gathered from across the country to discuss the topic with this wide spectrum of California transportation stakeholders. The conference helped establish a common language for developing the measures, identify critical issues and opportunities related to development and implementation of the measures, and receive input from a broad stakeholder community.

To supplement the findings from the conference, a review was also conducted of existing transportation system performance measure frameworks from other states and from California regional transportation planning organizations. The review sought to highlight the variety of approaches taken and to identify areas of consistency in approach so that California might build upon what others had already accomplished.

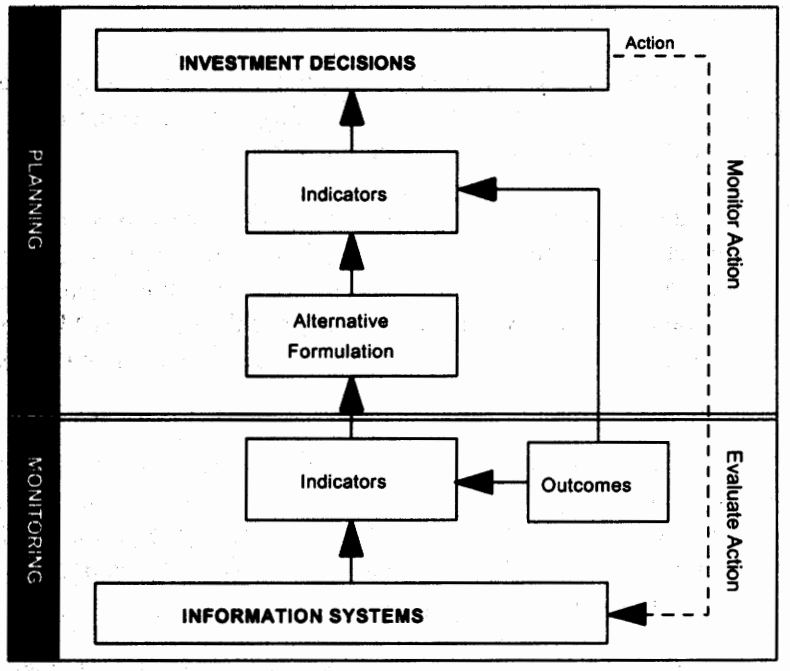
Public input was received from meetings held in various cities to present findings and to solicit reactions and suggestions. Formal presentations were made to several regional transportation planning organizations and to statewide transportation committees

The development group laid out the following design criteria:

- Indicators must be easy to use/simple to understand
- Indicators must be measurable across all modes
- Indicators must use existing data sources, and conform to existing performance activities (Metropolitan Transportation Commission, Southern California Association of Governments, ITMS[already developed in California] etc.) where and whenever possible

A key feature of the intended system was the need to both monitor existing conditions and forecast performance based on potential improvements, i.e., a set of metrics for both operations and planning, a performance measurement system that transcends traditionally separate functions. The diagram below depicts this relationship: outcome-based indicators reporting on

system performance; proposed planning alternatives measured against those very same indicators; and a decision made with performance in mind, then feeding back into future performance monitoring with the hope of validating or re-calibrating the prediction.



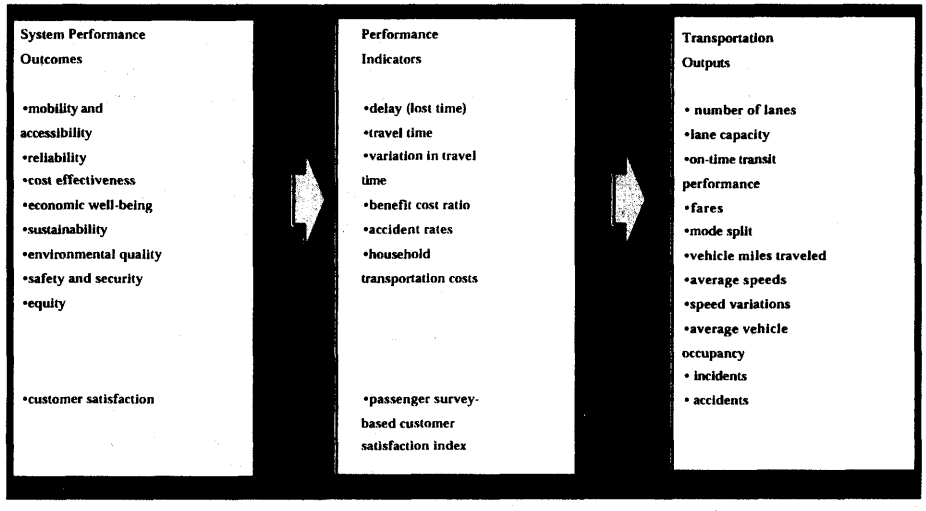
That same concept can be seen in the chart below which shows how performance monitoring is used to drive reporting, but is used as well for real-time operations, and in turn, for planning system improvements

Finally the development group determined the following outcomes to be the important results used to measure system performance:

- MOBILITY/ACCESSIBILITY -- Reaching desired destinations with relative ease within a reasonable time, at a reasonable cost with reasonable choices.
- RELIABILITY – The level of variability in transportation service between anticipated (based on scheduled or normal travel) and actual travel.
- COST-EFFECTIVE -- Maximizing the current and future benefits from public and private transportation investments.
- SUSTAINABILITY -- Preserving the transportation system while meeting the needs of the present without compromising the ability of future generations to meet their own needs
- ENVIRONMENTAL QUALITY -- Helping to maintain and enhance the quality of the natural and human environment.
- SAFETY & SECURITY -- Minimizing the risk of accidents, death, injury, or property loss.
- EQUITY-- Fair distribution of benefits and burdens
- CUSTOMER SATISFACTION -- Providing transportation choices that are convenient, affordable and comfortable.
- ECONOMIC WELL-BEING - Contributing to economic growth

In relative terms, it was a piece of cake to agree on the outcomes, compared to the effort to identify specific indicators to be used for the actual performance report card and to develop the implementation plan. Both activities are still underway.

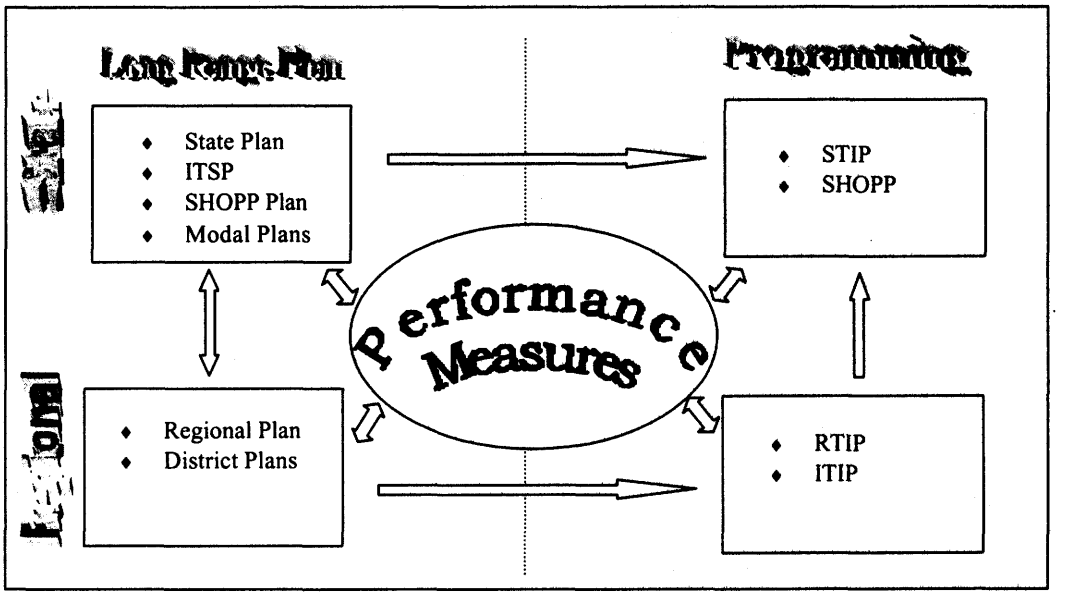
The initial set of indicators is depicted as follows:



As you can see, outcome-based performance measures as direct quantification's of the desired results, are almost non-existent. Performance indicators are useful when a direct measure either does not exist or when it is cheaper and more efficient to track a surrogate. Except for customer satisfaction, California is relying on indicators for performance assessment, but it is not forgetting the actual outputs that one way or another are responsible for outcome production.

Decision Making Linkage

As noted earlier, California wanted a toolkit for a range of decision-makers, in a sense, a very ubiquitous approach. Initial efforts have focused on the traditional transportation planning and programming processes as shown below. Planners are working to incorporate performance measurement into the regional and statewide plans which often include projects, more like a program. Yet, there has been a strong reluctance on the part of regions to apply performance measurement at a project level, opting instead for an aggregated approach in the full plan or program.



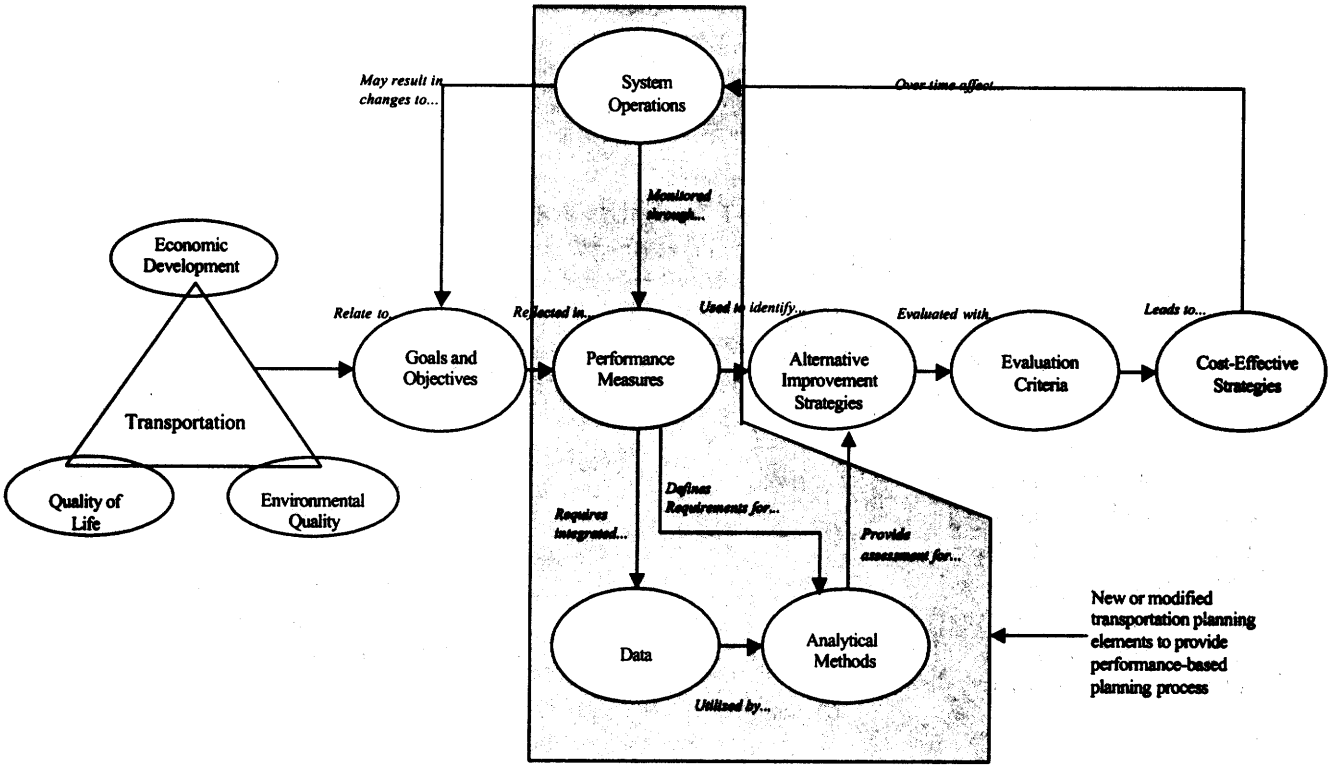
Interregional Transportation Strategic Plan (ITSP) State Transportation Improvement Program (STIP) State Highway Operation and Protection Program (SHOPP) Interregional Transportation Improvement Program (ITIP)

It is questionable whether plans in aggregate can produce noteworthy performance improvements, if the individual project components are not scrutinized under the same performance microscope.

It was never intended for performance measures to replace political acumen and there is a continuing need for political processes to weigh the merits of all outcomes, because there is no built-in mechanism for weighing one outcome indicator against another. The aggregate value has to be interpreted by the decision maker. Safety and preservation or maintenance are statutorily prioritized in California, but there still is balancing done between all programs and we have yet to see performance measures impact in this area.

System Management – The Real Context

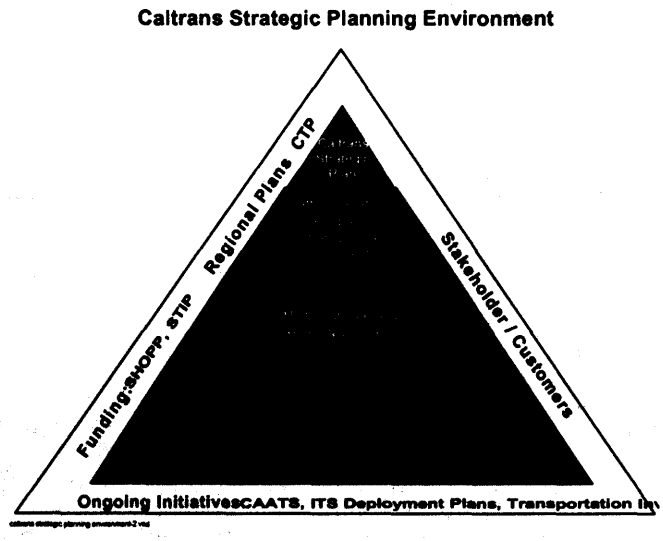
In 1999, the Caltrans Traffic Operation Program developed a Strategic Plan – "Managing for Safety & Mobility", which embraced the performance-based transportation planning approach which ultimately appeared in NCHRP Report 446



Functional integration within major organizations, cross-organizational integration and operation, and, finally, jurisdictional integration, will be instrumental to improved system management and performance. All are essential to success in the emerging system management era. It is clear that California needs a system management master plan comparable to its 1959 Freeway and Expressway Plan; i.e. just as it took vision sufficient for political commitment and staying power to implement or build the highway system, so too will it require a vision for system management that commits the state to a long term program for system management. The Operations Strategic Plan has identified the need for multi-jurisdictional relationships that yield the equivalent of the system management and coordination evident during the Los Angeles Olympics. In the latter case, it was accomplished by bringing the critical players together to share decisions and prevent individual decisions from co-opting overall system performance.

The integration and coordination of the various functions within the Department has always been a challenge particularly for implementation. The Operations Strategic plan marked a step

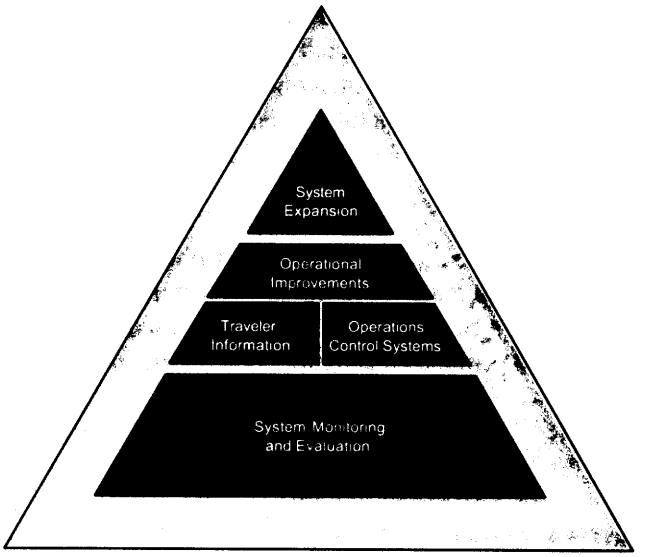
towards achieving some of that coordination, both in the emphasis on performance and the bridging of various planning activities as depicted below:



The message was and is quite simple. Departmental strategic planning and State transportation planning had to be in step. The Traffic Operations Strategic Plan, heeding the Department's Strategic Plan call for "system optimization" was the beginning of a process to institutionalize a system management approach to operations that can only work when it is integrated across all functions, much as depicted in the NCHRP report. How is it we seem to have avoided such a simple concept for so long: sound planning, leading to better programming, resulting in delivering the right improvements, all anchored on performance.

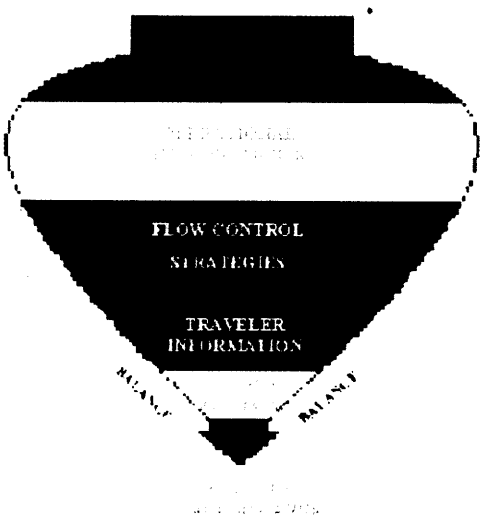
Caltrans has also been developing a System Management Strategy, known as "TOPS" as an initial skirmish in the aforementioned "operations" revolution. As you can see in the diagram depicting system management, TOPS reinforces the foundation of system management – system evaluation..

"TOPS" SYSTEM MANAGEMENT



It also advocates build out of an intelligent system to support aggressive system management starting with improved evaluation and monitoring, enabling more aggressive control strategies while offering real-time information, identifying the improvements that will impact performance, be they operational in nature or additional capacity. All of this within the complicated political context of a myriad of partnerships which must address the crux of the matter – demand.

This critical factor is better seen in the following spin on "TOPS": keeping the system in balance by addressing demand either by managing around it, operating through it or expanding to accommodate it.

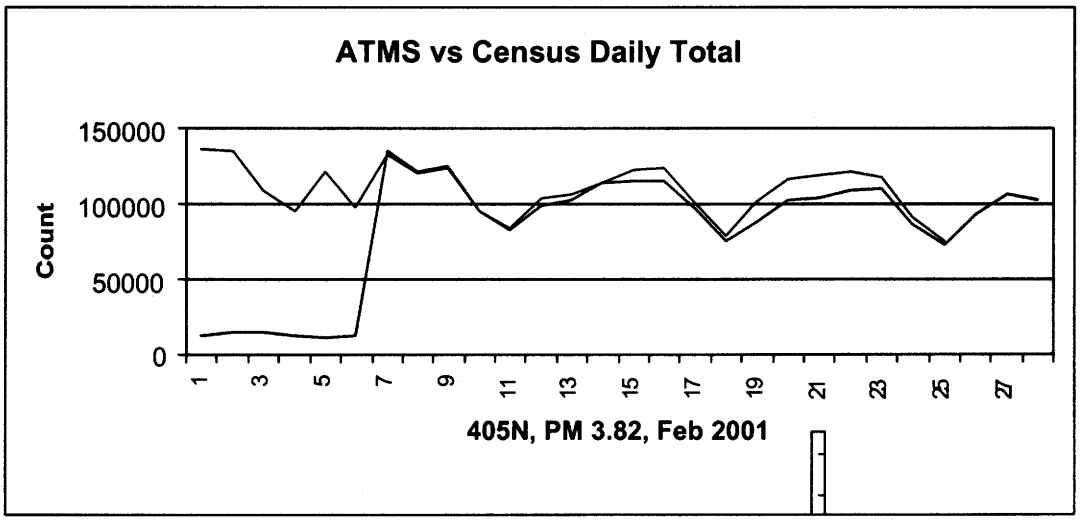


Data Needs

Sound information is the foundation for sound management. Good data is a non-substitutable ingredient to a well-prepared and functioning management information system. In California's performance measurement case, we established a design criterion which required a dependence on existing data. Fortunately, we have been developing real-time information capabilities for over a quarter century, and will soon have an extensive data collection network in urban area to provide data for the critical mobility/accessibility and reliability measures indicated earlier.

There have been constant debates over which technology to pursue and how expensive it is to deploy. Caltrans has an effort underway to prepare data specifications for detection systems, i.e. functional requirements primarily from the planning and operations programs (with design, construction and other considerations). The intent is to integrate data collection efforts across functions and programs. It is also the first step in developing a detection plan to support the buildout of an intelligent transportation system.

The good news is, as the chart below reflects, that we can meet multiple objectives with a single system, in this case traffic census volumes reporting (currently a partially stand alone data collection system) and traffic management systems.



The bottom line is the ATMS data. The gap in data for the first week of February highlights another potential problem, i.e. the reliability of your collection system. Detector stations not reporting is a performance issue unto itself. Suffice it to say that moving to a new generation of data systems is a birthing experience not without labor and pain.

On the following page is the initial draft of a chart showing the key needs and estimated performance levels. The intent is to find opportunities to deploy an intelligent transportation system infrastructure which accommodates as many of the needs with as few systems as possible. This was met with universal scorn in some corners ranging from over-simplification to impossible. We are working to map the connections in more detail and probably identify

multiple standards for different conditions, e.g. urban/rural, gradually raising the bar to capture good travel time and origin/destination data from our detection system.

DRAFT KEY FUNCTIONAL DATA NEEDED
AND LEVELS OF DATA ACCURACY*

Data	Level of Performance	Primary Need
Occupancy	± 5% error for 30 second aggregates	Ramp Metering
Volume	± 5% error for 30 second aggregates	Traffic Studies and Census
Classification (vehicle type)	± 2% error	Truck Counts; Pavement Studies
Speed (measured at single station)	± 10%, unless doing travel time and O&D will need higher accuracy	Single Loop Station Speed Accuracy
Vehicle Locator	3 meters	Lane Position
Travel Time	± 5% error between stations	Traveler Information
Origin & Destination (O/D)	99.8% accuracy between adjacent sensor stations	Determination of Trip or Route O/D
Incident	98% in detection and direction	Timely Incident Clearance
Weight	Operates 99% of time Accuracy of 95%	Pavement and Truck Studies
**Passenger Occupancy	90% correct SOV Identification	HOV studies
**Emissions	± 5% error	Environ. Studies

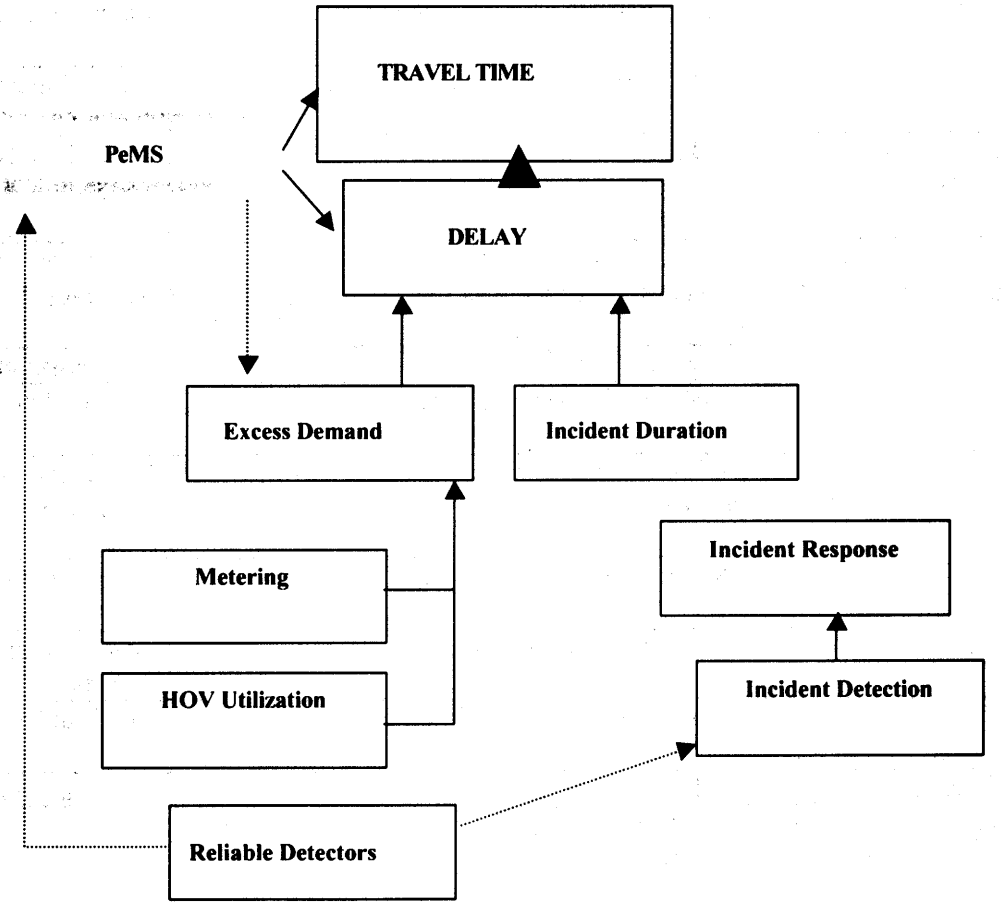
*Based on internal program's needs, but need to be validated per matrix attached

**Need to be addressed separately

My Measure is Better Than Your Measure

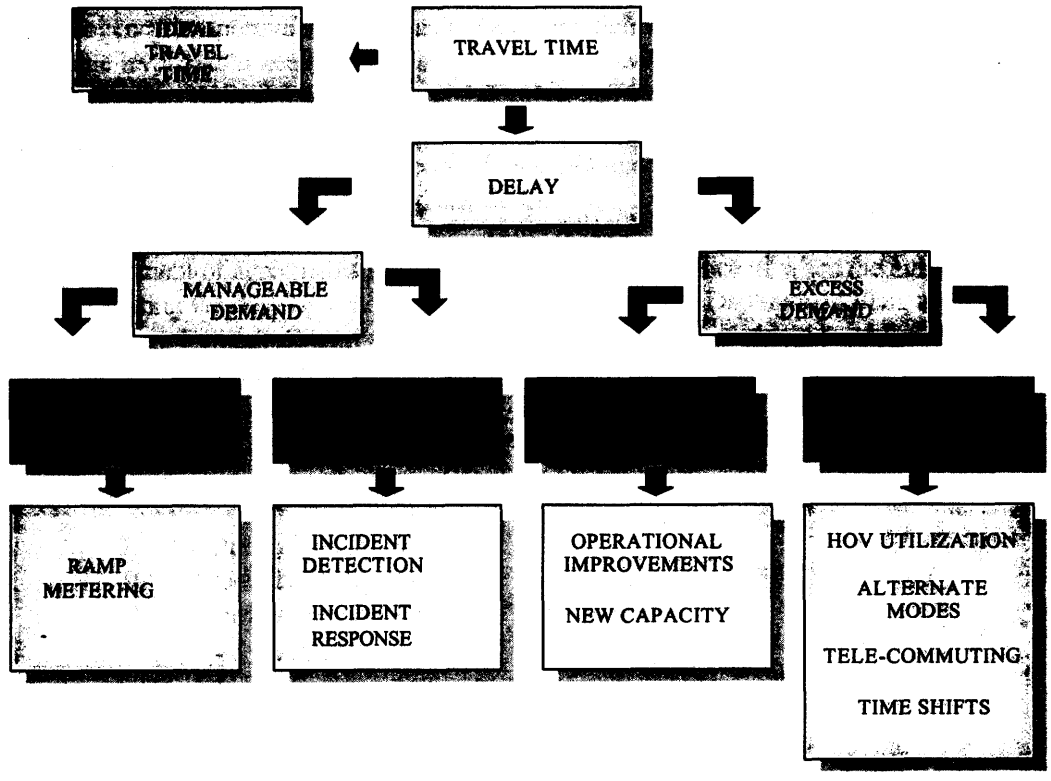
Few of the transportation outcomes identified earlier are directly measurable and require indicators for performance as opposed to direct measures (exception is customer satisfaction). In looking at the various performance measurement exercises underway nationally, it is easy to discern similarity in focus. While the formats and use of terms may vary widely, the results deemed important differ very little (mobility, reliability, safety, environment, equity etc.) However, a common end doesn't seem to dictate a common means. There are two dimensions to this phenomenon: quantity and scale. It isn't merely a question of how many. It is also an issue of where and when. In Traffic Operations at Caltrans we are responsible for supporting the Statewide Performance Measurement effort by reporting the State Highway System contributions to performance in the critical areas of mobility and reliability as well as safety. For overall reporting purposes, this is not very complicated. We tabulate travel times and delay and look at

the variability. For managing our program, i.e. connecting the various activities undertaken within Traffic Operations with these critical results, it is another matter. While the general dictum of measure as little as possible works at the outcome level, it is almost impossible at the output level where actual production has its genesis. Consider the following example:



Note! PeMS is a performance measurement tool drawing data from loop detectors

The previous example highlights but a few of the activities in Operations alone that help determine system performance. In order to understand how effective individual system management strategies or tactics are you need to measure at the various levels. You also should be tracking efficiencies e.g.; if your detectors aren't working, it is unlikely you'll discover your problems as quickly as you could. If you don't respond and clear quickly, you can't expect to minimize delay. While all of this is patently obvious, I must confess, we have yet to build this integrated and layered approach to performance measurement in California. Nonetheless, we are working to integrate a host of activities to improve system performance as measured by travel time.

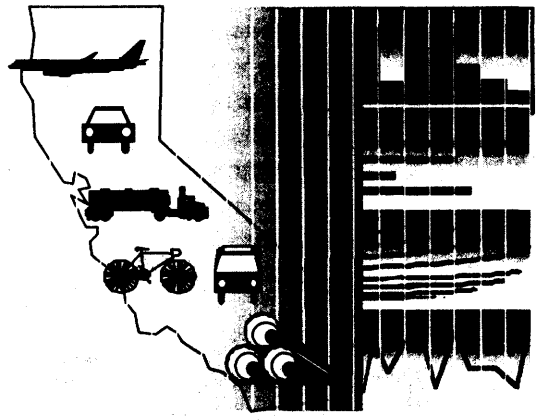


The second example above shows how additional elements come into play. Yet, it is still far from the complete picture of all the activities that influence travel time. How about land use and access management for starters.

The point cannot be overstated. No matter how much you strive for simplicity, complexity prevails. Genuine systems approaches cannot avoid complex inter-relationships.

State of the System Report

In October of 2000, Caltrans issued a "prototype" of a State of the System Report to demonstrate how performance information can be collected, reported and communicated.



This prototype is available at http://www.dot.ca.gov/hq/tsip/tspm and is not intended as a decision making document, yet. It covers only four outcomes and highlights integration as a significant challenge:

> *"Full implementation of system performance measures faces a second set of challenges, namely to integrate performance measurement into the planning, programming, operations, and project development processes. Ultimately, decisive information generated through performance measurement will influence decision making within Caltrans. For performance measurement to truly become effective, it has to permeate the entire organization and be incorporated into short and long range planning products, operational analysis techniques and documents, priority setting for programming, and project development activities. A key challenge is the continued* management *support for performance measurement."*

It is expected that this prototype will evolve into a routine report card for transportation in California, not unlike the federal efforts at the national level. The prototype is well over one hundred pages, not a very propitious omen for those hoping for a few simple indices like the Dow Jones Average or a weather forecast.

Lessons A Learning

The maximum benefits from better system management will not be realized until considerable integration is achieved. Performance measurement can and should be the *lingua franca* for such integration, with mutually acceptable and well-defined outcomes acting almost like common denominators. To achieve such a state of system management and performance measurement is a long and arduous journey. The following pitfalls assure that:

- Data Availability – While it is comforting to follow design simplicity by relying on existing data, it isn't always realistic. Existing data is often weak or scarce, and parochial preferences can be genuine obstacles, e.g.; disdain for HPMS, lingering legacy systems by definition anti-integration, and lack of support for an Intermodal Transportation Management System developed by Caltrans prior to performance measurement effort.

- Integration across Jurisdiction with Local/Regional Efforts – Another essential ingredient, posing quite a challenge. Not unlike the propensity for distinct modeling efforts from region to region, most parts of the State claim "uniqueness" and a need for specialized assessments, opting for less than full integration with the State effort.

- Ability to be Truly Modally Blind – Don't fool yourself and think that indicators can span the modal divide. Most modes will require indicators tapered to their own circumstances, e.g. on-time performance for transit rather than an outright travel time comparison.

- Internalizing All Externalities – It is very difficult to define broader social goals in easily measured terms. No one is truly against livable communities or sustainability, but there is disagreement as to what they mean and how we can measure them. We have a lot to learn and must continue the dialogue, no matter how frustrating, in search of a common understanding of the greater good.

- Absence of a True System Manager – Different states and different metropolitan regions have varying issues to confront in developing integrated management systems. Some regions and states have it easier than others, particularly those places less balkanized. Clear definitions of roles and responsibilities are inescapable if the multi-party transportation environment most places face is to produce in a systemic fashion. The Olympic effort in Los Angeles was advanced by the designation of what amounted to a "czar". Such command and control approaches aren't always popular, but some thought should be given to assigning overall system management to a single agency with sufficient authority and resources to execute effectively.

- Customer as Co-Manager – American travelers are savvy, if not always sensible. Traveler information is needed to reinforce the former, and public education and outreach is a must to minimize the latter. Failure to appreciate the value of metering, pricing and high occupancy strategies will result in resistance to better management.

Conclusion

You can't have system management without extensive integration. You can't have extensive integration without common platforms for establishing goals, objectives and performance measures, and you can't have either without commitment and leadership.

When we finally tired of the rule of George III and set out on our own, we didn't abandon much of our Anglo-Saxon heritage. So too today, as many call for the head of the current king – the automobile, we will retain the benefits of that mode, while managing our system more efficiently.

We have begun to hear the shots at Lexington and Concord Bridge. Must we endure a Valley Forge before we reach our Yorktown?

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